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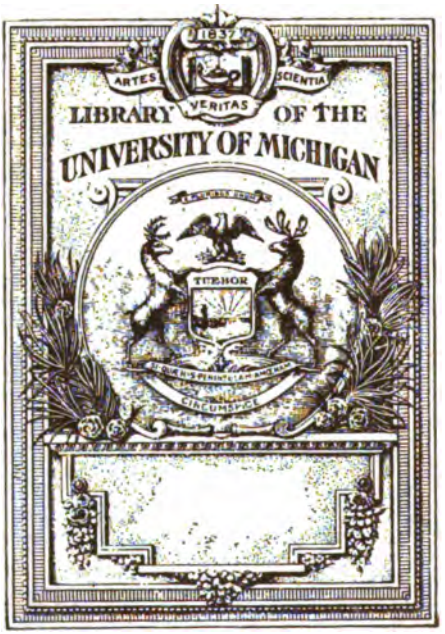

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PROCEEDINGS

OF THE

National Safety Council

TENTH ANNUAL SAFETY CONGRESS

Held at the
State House
Boston, Massachusetts
September 26-30
1921

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National Safety Council

168 North Michigan Avenue, Chicago

HONORARY MEMBERS

Association of Iron and Steel Electrical Engineers.
Elbert H. Gary, Robert W. Campbell, Ralph C. Richards.

OFFICERS (1921-1922)

Arthur H. Young, President.
David S. Beyer, Vice-President in Charge of Service to Members.
B. F. Tillson, Vice-President in Charge of Industrial Safety.
David Van Schaack, Vice-President in Charge of Public Safety.
C. B. Scott, Vice-President in Charge of Local Councils.
F. A. Davidson, Vice-President in Charge of Sectional Activities.
W. E. Worth, Secretary and Treasurer.
W. H. Cameron, Executive Secretary.

EXECUTIVE COMMITTEE (1921-1922)

C. B. Auel, Westinghouse Electric and Manufacturing Company.
David S. Beyer, Liberty Mutual Insurance Company.
M. F. Bramley, Cleveland Safety Council.
Robert W. Campbell, Illinois Steel Company.
F. A. Davidson, Construction Section.
Marcus A. Dow, New York Central Lines.
E. H. Fitzgerald, Milwaukee Safety Council.
H. W. Forster, Engineering Section.
Isaiah Hale, Steam Railroad Section.
Walter C. King, Julius King Optical Company.
G. H. McClain, Louisville Safety Council.
J. H. Mulligan, Metals Section.
J. F. Naylon, Public Utilities Section.
B. W. Nutt, Safety Equipment Service Company.
J. A. Oartel, Carnegie Steel Company.
H. S. Potter, Boston Safety Council.
Dr. R. S. Quinby, Health Section.
O. T. Remmers, St. Louis Safety Council.
C. G. Rice, Pittsburgh Safety Council.
R. C. Richards, Chicago and Northwestern Railway Company.
J. A. Robertson, Rochester Safety Council.
Chas. B. Scott, Bureau of Safety.
B. F. Tillson, New Jersey Zinc Company.
C. P. Tolman, National Lead Company.
E. B. Tolsted, Wynkoop Service.
David Van Schaack, Public Safety Section.
H. M. Webber, Illinois Bell Telephone Company.
A. W. Whitney, National Casualty and Surety Bureau.
W. E. Worth, Chicago Safety Council.
Arthur H. Young, International Harvester Company.

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CONTENTS

	Page
Annual Meeting of Members	5
General Session: Public Safety and Education	33
General Round Table (Safety Bulletins)	45
General Session: Engineering and Safety	49
Joint Meeting of Manufacturing Sections	77
General Session: Health and Sanitation	97
A B C Session	121
Automotive Section	143
Chemical Section	185
Construction Section	207
Education Section	237
Electric Railway Section	249
Employees' Benefit Associations	267
Engineering Section	281
Health Service Section	295
Local Council Officers	343
Metals Section	365
Mining Section	399
Packers and Tanners Section	499
Paper and Pulp Section	539
Public Safety Section	569
Public Utilities Section	621
Rubber Section	683
Steam Railroad Section	723
Textile Section	815
Women in Industry Section	837
Woodworking Section	859
Index	905

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THE complete stenographic report of the 56 meetings which made up the Tenth Annual Safety Congress would fill more than 2,000 printed pages. These Proceedings have been reduced to less than one-half of their original volume, partly to keep the cost within a reasonable limit, and also for the convenience of the average reader who desires only a condensation of what was said and done at the Congress. The prepared papers which occupy the greater part of this book are reproduced in full or very slightly condensed. It is on the extemporaneous discussions that the editorial blue pencil has been used most freely, compressing pages into sentences and cutting out irrelevant matter entirely.

To the chairmen of meetings a special apology is due, for the ruthless elimination of their graceful introductions and their skillful drawing out of discussion and debate, which added so much life and color to the meetings themselves.

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PROCEEDINGS

of the

NATIONAL SAFETY COUNCIL

TENTH ANNUAL SAFETY CONGRESS

Held at the
STATE HOUSE
Boston, Massachusetts
September 26-30, 1921

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National Safety Council

Annual Meeting of Members

Boston, Massachusetts

September 26, 1921

PRESIDENT CHARLES P. TOLMAN, Presiding Officer

AFTER the invocation by Reverend Edward A. Horton, D.D., Chaplain of the Massachusetts State Senate, President Tolman introduced Mr. Howard Coonley, President of the Massachusetts Safety Council, who delivered the following address:

ADDRESS OF WELCOME

HOWARD COONLEY, PRESIDENT, WALWORTH MANUFACTURING COMPANY, BOSTON, AND PRESIDENT, MASSACHUSETTS SAFETY COUNCIL

The appalling list of accidents which have killed or maimed hundreds of thousands on the highways, in city streets, office buildings, factories, even in homes, is sufficient justification for this convention. In trying to arrive at means to prevent accidents, you are performing not only an economic, but a humanitarian service, and you should feel encouraged to know that so much tangible progress is rewarding your efforts. Especially do we in Massachusetts see the results of the Safety Council's work, which is now being carried out along practical and scientific lines.

During the past year the scope of the Massachusetts Safety Council has been broadened to include not only accident prevention work in the industries of the city, but wherever the public may be endangered by carelessness or indifference. The Massachusetts Council is now reaching out to win the close co-operation of the community under the perfectly sound theory that accident prevention is a community and social problem. It has brought together in this effort all the various organizations which are seeking accident reduction—the activities of the Safe Roads Federation, the local safety councils in Massachusetts cities and towns, and women's organizations such as the Federation of Women's Clubs of Massachusetts, League of Women Voters, and parent-teachers' associa-

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tions have been co-ordinated, and now we are glad to say that tangible results are being obtained.

This is "No Accident Week" in Massachusetts. Every day we shall have demonstrations in the schools. Safety workers will visit every schoolroom in Massachusetts and will leave a valuable lesson on the importance of exercising care and reducing the number of deplorable mishaps which daily wipe out so many young lives. Every day on Boston Common, and in similar public spots in other cities and towns, during the noor hour, safety demonstrations are being made. In Boston the state constabulary, Red Cross, the Boston police, Boston fire department, Girl Scouts, and the Boy Scouts are participating in these demonstrations to help the public visualize results of carelessness and indifference. We feel that this will result in awakening the public to the importance of this problem. It is a start in the direction of educating the public, which, to my mind, is the only solution of this great problem of accident prevention.

Mr. MacBrayne, general manager of the Massachusetts Safety Council, is approaching this work in a practical and scientific way. It seems to me that an effort of this sort, where results must always be largely intangible, too often is carried out along purely theoretical lines. The application of science to any enterprise is merely, after all, the application of exact knowledge. Mr. MacBrayne and his helpers are basing their activities on known facts. I think one of the most striking examples is the work that is being done to prevent automobile accidents on the open highways in Massachusetts.

Those of you here who came to Boston by automobile saw at many places on the roads where possible danger existed, great white lines and arrows indicating a curve ahead and serving as a guide to drivers of automobiles. The value of these lines becomes strikingly apparent at night, and I have no doubt that they have prevented many accidents on the road. This work was carried out by the department of public works in co-operation with the Safety Council, which conducted a study of the highways to determine where the greatest danger existed.

Not long ago the tercentenary celebration of the landing of the Pilgrims was held at Plymouth, and thousands upon thousands of visitors made their way by automobile down the South Shore, which, even in normal times, is heavily congested with traffic. The Massachusetts Safety Council foresaw that in the weeks of the Plymouth celebration many thousands of automobiles would travel over the South Shore road to Plymouth. Agents of the Council made a study of the road to determine where the most accidents occur and where traffic congestion was most likely to be serious. Conferences were held with officials of nine towns, between Boston and Plymouth and with the police of those towns, and the utmost precaution was taken to prevent accidents. In six weeks of tremendous traffic over this road, there was not a single fatal accident.

All of you who have to do with accident prevention work in the industries have found, I have no doubt, that the business depression is putting barriers in your way. Some industries are pulling out from

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accident prevention activity. It seems to me that this is a big mistake. In times such as these, it is a fact that accidents are more frequent in industry than in normal times. Stopping the work because of business depression is, in my opinion, short-sighted policy. Here again the need of education is apparent. Management too often looks at accident prevention as merely a program to stop labor turn-over and to prevent machines from lying idle because of operatives being injured. It is much more than that. It affects the attitude of the public toward industry and has a tremendous influence upon the efficiency of workers.

I feel that we should be encouraged not only by progress already made, but by the attitude of the public and the press in support of safety work. Everywhere the Massachusetts Safety Council has met with co-operation. This is particularly true of the state officials having to do with the regulations of highway traffic and the industries of the state. The department of public works, the state registrar of motor vehicles, the commissioner of public safety, school officials, our most important industrial associations, the heads of our labor organizations, and the managements of our largest industries are lending their aid to this movement. The press gives liberal space for propaganda, and we can reasonably expect that great strides will be made in the coming year to educate the public to the vital importance of accident prevention.

Mr. David S. Beyer, as Chairman of the Committee of Tellers and Inspectors of Election, reported that the members present in person, together with the proxies on hand, constituted more than the legal quorum. The address of the president was then given.

PRESIDENT'S ADDRESS

C. P. Tolman, President, National Safety Council, Chief Engineer and Chairman Manufacturing Committee, National Lead Company, New York City

The columns of the *National Safety News* and the reports of officers charged with the responsibility for the several departments of the Council's activity which will be submitted to you in the course of this meeting give you complete detailed information concerning the routine activities of your organization. I conceive it the duty of the president to emphasize those developments which mark the progress of the year and particularly such as have to do with the policy of the Council.

The treasurer's report, as you naturally expected, reflects general business depression. While cancellation of memberships has been severe, it has usually been accompanied by a letter explaining that the factory had been closed or operations curtailed, adding that it was the purpose to renew membership upon resumption of business. In many cases membership has been continued in spite of reduced operations and we have received many letters from the chief executives of the member company giving the warmest endorsement of the Council and expressing the feeling that the Council should be supported regardless of any general

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policy of retrenchment because of the unique position occupied by the Council in the industrial world, recognizing that an organization built up, as the Council has been, through the painstaking service of thousands of men must not be impaired for it could not be rebuilt. In spite of the cancellations we have at the same time acquired new members and in respect to number of members the Council is operating on a 90 per cent basis. Unfortunately, this does not reflect the financial situation because the new members are for the most part small companies, and the revenue from other sources also has been reduced.

To meet the situation it has been the unpleasant duty of your Executive Committee to make a drastic reduction in the staff. From a total personnel of 44 the staff was reduced to 30. It was then found necessary to make further retrenchment and it was decided to reduce the salary of every member of the staff, from the general manager down; a reduction of ten per cent was accordingly made. Let us get this thought clearly before us; we reduced the staff from 44 to 30, distributing the work of the 14 among the remaining 30; and then we reduced their salaries 10 per cent. Yet I doubt that you have noticed the reduction in volume of service; it has been so slight. This result has been obtained by hard work under most thoughtful and efficient direction.

The Council should deeply appreciate the devotion and efficiency of the staff at Chicago. Let us remember that in this group of thirty *employees* we have thirty loyal *active members* of the National Safety Council.

Reference to the financial situation would be incomplete if I did not tell you of the debt we owe Mr. Worth, vice-president and chairman of the Committee on Finance and Business Administration. To his ability and his devotion to the work of his committee we owe the fact that beginning with a seriously reduced surplus a year ago followed by the depression to which I have already referred, the Council now finds itself on a sound operating basis with definite assurance of continued improvement.

In closing what I have to say on the financial situation there is a point which should be brought out. Mention has been made occasionally of the "overhead" expense of the Council, referring to the Chicago headquarters salaries. This expression cannot properly be used in that connection. Overhead expense, in the correct sense of the term, referring to salaries, means expense of supervision not directly productive. There is naturally supervision, but the outstanding fact is that every member of our paid staff is directly engaged in producing the Council's service. Executive supervision which corresponds to the overhead expense of concerns in general is contributed by member companies through the services of the elected and appointed officers of the Council. In no other way would it be possible for the National Safety Council to render its present service at the surprisingly small membership dues.

READJUSTMENT OF RELATION BETWEEN LOCAL AND NATIONAL COUNCILS

Shortly following the Milwaukee Congress your officers and Executive Committee realized the pressing necessity of clarifying the relation

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between the National Safety Council and the various local councils. It was regarded as imperative for two reasons: whereas a number of local councils had been organized, no two of them were functioning in the same manner, nor was there any semblance of uniformity in the relationship between these locals and the national Council. This was regarded as an unhealthy condition and a possible source of misunderstanding. Furthermore, it was felt that public safety demanded more intensive development and that this could only be brought about through local councils. To make this possible readjustment of the relation of the National to the local councils was necessary along lines that would foster the development of the locals by granting them greater latitude in membership, by giving them representation on the directorate and in the Executive Committee of the Council, and by developing special lines of service from the National Council to the local councils. A committee was appointed under the able chairmanship of our past president—and one of our founders—Robert W. Campbell.

The problem was far from simple. By correspondence and conference the committee sought information and opinions from all of our members who were especially informed on the subject. During a period of many months several "progress" reports were submitted to and discussed by the Executive Committee, culminating in a final report submitted to the Executive Committee at its meeting at Chicago last August. This report was so exact in its analysis of the situation and so satisfactory in the procedure recommended that after consideration section by section it was unanimously adopted without change. The committee was then requested to prepare in form for adoption at this meeting the necessary changes in the by-laws of the Council. To insure the fullest possible consideration before presenting the matter to the whole membership of the Council, all local councils were invited to send delegates to meet with your directors at a meeting which was held here in Boston immediately before this Congress. At this meeting the whole matter was gone over in detail and the action of the Executive Committee was confirmed. The proposed changes in By-Laws will be submitted for your approval later in the course of this meeting.

I consider the developments in the relation of the National Safety Council to the local councils one of the outstanding developments of the year in that it makes possible increased public safety activities through the local councils and while giving the local councils all possible aid and support, the end is accomplished without prejudice to the interests of the industrial members of the Council.

We of the National Safety Council never think of public safety without thinking of our good friend and General Manager—C. W. Price. Beyond question the credit for the development of public safety is due more to Mr. Price than to any other man. His clear vision, his unflagging enthusiasms, and his untiring efforts for the safety and welfare of his fellows have been a source of inspiration to us and to thousands throughout the country. In the broad field of safety work public safety work is the nearest his heart. You will, therefore, not be surprised to learn that

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he has definitely decided to withdraw from the staff of the National Safety Council in order to devote himself exclusively to public safety work in a personal and professional capacity free from the burden of executive detail which as general manager of the National Safety Council occupies the greater part of his time. May I suggest a rising vote as an expression of our appreciation of what the leadership of Mr. Price has meant to us and the National Safety Council?

(Rising vote of thanks.)

CHANGE IN BULLETIN SERVICE

The backbone of the Council's industrial work has been the bulletin service. In connection with this service, there is one problem which has been repeatedly reviewed—that is, the difficulty of supplying bulletins of the widest possible use to the members at large without an excessive number which are not useful at all. The problem became more and more difficult with the growth of the safety movement as it passed through the propaganda period and entered the present phase of development in which specific information is necessary rather than the generalities of earlier days. The problem is further complicated by the wide range of industries served. Eighteen thousand sets of bulletins are mailed each week, and you will at once realize the impossibility of attempting to sort these sets, omitting certain bulletins from one set, certain other bulletins from another, and so on. It has been unavoidable in the course of the year that of the bulletins received by any one member, many were not suited to his use although needed by another. You will be interested to know that a plan has been devised which we believe may solve this problem and at the same time in connection with orders for extra bulletins, extra Safe Practices pamphlets, and other special service will save carrying on our books the largest part of some twenty thousand accounts. The details of this plan will be gone into later in the week, and it is expected that everyone particularly interested in the subject will make a point of attending so that a full discussion may be had.

ENDORSEMENTS OF NATIONAL SAFETY COUNCIL'S WORK

During the year, the national importance of the work of the National Safety Council has been recognized as never before.

You will recall among the letters of endorsement appearing on the front page of the *National Safety News* a personal communication from President Harding which was notable for the thorough understanding displayed of the scope of the Council and the importance of its work from the standpoint of national welfare.

Later in the year you were informed through the columns of the *National Safety News* of a special action taken by the Chamber of Commerce of the United States in the form of a resolution endorsing the work of the National Safety Council and asking the co-operation of the membership of the Chamber of Commerce of the United States with the National Safety Council.

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Finally, fellow members, we find ourselves here as the guests of the Commonwealth of Massachusetts meeting in one of the most historic buildings in our Country, a recognition of the high ethical plane upon which the affairs of the Council have been conducted, of the humanitarian character of our work, and its relation to national welfare. It is for us to maintain these standards. The keynote of it all is SERVICE. The purpose of this Congress is to enable us to render more and better service. It is your privilege to hear the ablest speakers in each branch of safety work. You are expected to do your share by taking part in the discussions to the end that each shall have the benefit of the experience of all, and that each of us may return home better able to serve!

Following the president's address, on motion it was voted to accept the minutes of the last annual meeting as printed in the Proceedings. The following reports of officers and committees were then presented and accepted:

REPORT OF THE GENERAL MANAGER

C. W. Price, General Manager

During the year just closed, a year of business depression and readjustmen from war conditions, the Council has been compelled to pursue a policy of retrenchment as will be revealed by the report of the Chairman of the Finance Committee. But notwithstanding the adverse conditions substantial progress has been made in many departments of the Council's work. Never in the history of the Council have such large demands been made for service and leadership both in the field of industry and public safety; never before have such opportunities for new and far-reaching developments opened to the Council, all of which indicates the rapid spread of the safety idea.

SERVICE TO MEMBERS

As in past years, the principal time and thought of the officers and staff has been devoted to maintaining and improving the service to members, which while not so novel or striking as some of the other activities mentioned later, is nevertheless recognized as the backbone of the Council's existence and the activity for which most of the members pay their annual dues.

BULLETINS

For the bulletins in the general and thirteen sectional series practically all of the material has been furnished without cost by the various bulletin committees and other members. Without this constant supply of material it would be quite impossible to furnish even the bulletin service alone, at the present cost of membership, thus proving again the strength of the Council as a co-operative association in which the time and energies of each member are contributed to the service of all. With

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the material thus furnished our staff has made every effort to produce bulletins that are striking and "different" and that will thus be of value in holding the interest of workmen.

A total of 3,078,000 bulletins were sent to members during the year, in addition to which 862,000 extra copies were purchased by members.

SAFE PRACTICES PAMPHLETS

Eight of these pamphlets have been prepared and distributed during the past year in addition to the Automobile Drivers' Lessons which were distributed in lieu of one pamphlet. The entire set of Safe Practices pamphlets now provides an almost complete encyclopaedia of information on the various phases of safety work including mechanical equipment, operating methods, and education of employees. Too much credit cannot be given to the Conference Committee of Safety Engineers to whose careful criticism in advance of publication is due the large measure of authority that these pamphlets possess. The services of Mr. R. J. Young. as chairman of the Conference Committee and final arbiter must be especially acknowledged. During the past thirteen months more than 10,000 extra copies of Safe Practices pamphlets have been purchased by our members.

NATIONAL SAFETY NEWS

Judging by the many expressions received from our members, the *National Safety News* is one of the most popular and useful pieces of service which the Council renders. The change in June from a weekly to a monthly magazine, which has been generally approved, has enabled our editorial staff to produce a better magazine, including articles based on first-hand investigation such as the studies each month of the safety work in some typical industrial properties made by our editor.

The interest of our members in the *News*, and their increasing generosity in contributing items of news and information out of their experience is making this magazine a great clearing-house for ideas and experiences, covering the whole field of both industrial and public safety as it is developing in this and other countries.

The editorial staff is endeavoring to develop a magazine which will not only be useful to the manager, the superintendent, and the safety engineer of a plant, but also a magazine which the manager will value as an effective medium through which he may reach his foremen each month with useful information and stimulus along safety lines.

The advertising pages of the *News*, continue to meet with the approval of our members, and to serve as a valuable index for information on safety equipment.

LIBRARY AND BUREAU OF INFORMATION

The many letters of commendation received from members evidence the growing appreciation of this service.

Notwithstanding the fact that the library staff has been greatly reduced since January on account of the necessity for retrenchment, the

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following report of work done does great credit to our most efficient librarian and her assistants:

Eight thousand and ninety-five books, pamphlets, clippings, photos and other pieces of information were received and properly classified on 4,704 catalog cards; 2,112 letters were dictated by the librarian in answer to inquiries for information, and 2,889 research reference requests were answered during the year by the library or the engineering department. There were 29,672 pieces of literature, including blue prints, photographs, clippings, N. S. C. publications, books and magazines, circulated outside of the library in reply to these 2,889 research requests. A striking feature of the reference work was the greater distance from which inquiries came, as compared to former years—Australia, Sweden, Africa, Syria, Philippine Islands, China and Japan.

Ten exhibits of safety literature have been prepared for local councils, public libraries, Red Cross societies, first-aid meets, health and sanitation expositions and for the 1920 Congress.

LOCAL COUNCILS

At the time of the last Congress, the following fifteen cities and one state had councils with paid staffs:

Buffalo, Chicago, Cincinnati, Cleveland, Grand Rapids, Kansas City, Milwaukee, Minneapolis, New York, Pittsburgh, Portland, Rochester, St. Louis, St. Paul, Syracuse, Delaware.

During the past year, seven other local councils with paid staffs have been added to the list:

Bridgeport, Detroit, Flint, Los Angeles, Louisville, Waterbury, and the Massachusetts Safety Council, the manager of which is also the manager of the Boston Local Council.

The managers of the Bridgeport, Flint and Waterbury Councils devote only part time to the work.

In Sioux City, Iowa, a local council was organized without a paid staff.

As a result of the interest which has been awakened in New England because of the coming of the Congress and the No-Accident Week, definite steps have been taken towards the organization of a local council with a paid staff in each of the following cities: Providence, Springfield and Worcester. Similar steps have been taken in Baltimore, following a successful no-accident week campaign.

The one most direct and valuable service which the local councils have rendered the industries during the past year has been through the schools for safety supervisors and foremen. In twenty cities these schools have been conducted with an attendance of 9,200 men, under whose direct supervision over a million workmen are employed.

Judging by the many reports received from plant managers, the men who attend the ten or fifteen lessons given in these schools, and receive a diploma, go back to their shops not only equipped with valuable information but convinced, and in nearly every case begin to apply their knowledge.

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PUBLIC SAFETY

The past year has witnessed a marked increase over the entire country of interest in accident prevention as reflected in the wide publicity given the movement by the newspapers and the leading magazines. This interest is due largely to the rapidly spreading alarm over the increase of deaths from motor vehicles, which in all the large cities, and in many of the smaller communities, is resulting in a demand on the part of the people for some organized effort to control this hazard. In the minds of the majority of the people, the one accident problem now demanding immediate solution is the automobile hazard. During the next few years, the effort to cope with this problem will furnish a great stimulus to the organization of new local councils.

While the National Safety Council has had very limited funds available for public safety work, much real progress has been made at a minimum cost, by giving assistance to the organization of public safety activities in nearly all local council cities.

In the local councils, public safety is coming to occupy an increasingly important place on the program. One of the interesting developments of the past year has been the rapid spread among the Council members of the conviction that the only adequate solution of the problem of accidents in the industries, on the streets, and in the homes, is to organize safety as a community affair, and through the leadership of influential citizens to conduct such an aggressive and continuous campaign of education through the schools, the press, and the various civic agencies, that the interest of the whole community will be aroused and safety will be given a place, in the community life.

The managers of local councils are finding that the employers of labor are the first to appreciate the direct value to them of organized community safety in reaching their workmen and moulding them into not only safe employees but safe fathers and safe citizens.

In six of the local councils, schools for drivers of motor vehicles have been conducted with marked success. The twelve lessons compiled and published by the National Safety Council have formed the basis for the instruction. It has been found that the drivers who attend these schools not only go out of the school with much valuable information pertaining to the mechanical safety of their machine and safe driving, but, perhaps more important, they go out with a changed attitude towards the traffic officers, and a new realization of their obligation to drive safely.

In addition to the use made of the "Safety Lessons of Automobile Drivers" in these schools, some 30,000 sets have been sold to owners of trucks and insurance companies. A large number of automobile journals, automobile club organs, magazines, and newspapers have reprinted the lessons by permission of the Council.

The "no-accident week" has come to occupy an important place in developing community safety. Through the widespread interest which is aroused, and the convincing demonstration made by the marked reduction in accidents, it is found that a "no-accident week" is a most effective

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means of initiating a new local council, as well as stimulating interest in an established organization.

"No-accident weeks" have been conducted in the following eight cities, and one state, resulting in reduction of fatalities from 45 to 100 per cent: Baltimore, Buffalo, Cincinnati, Milwaukee, Minneapolis, Providence, St. Louis, Sioux City, and Massachusetts.

SCHOOL SAFETY

The campaign begun two years ago by the Education Section to reach the public and parochial schools and to secure the introduction of safety instruction, has been continued vigorously during the past year.

In the *National Safety News* each month, striking stories of what has been accomplished in the schools of various cities has been published and a strong appeal has been made to our members to place copies of the *News* in the hands of their local school board and to use every influence possible to persuade the board to authorize safety instruction.

From the many reports which have been received from our members, I believe we are justified in saying that in over 50 per cent of the cities and towns of this country, safety instruction in some form is now being given.

Because of the following facts, I believe school safety is destined to make great strides during the next two years, and may possibly become universally adopted:

1. The value of the use of safety material in the education of the child, and therefore its acceptability to the school men. Publishers are beginning to include safety material in the new school books recently published.

2. The immediate reduction of deaths to children in schools where safety is taught—in two cities a reduction of 50 per cent the first year.

3. The increasing toll of deaths of children from automobiles which is arousing parents to demand that their children be instructed in safety.

4. The discovery that the one most effective method of reaching the adult population and arousing a widespread community interest in safety, is through the school children.

MEMBERSHIP

The membership of the Council at the close of the fiscal year was 3,626, a decrease of 425 from last year. Most of this decrease was caused by the shutting down of industrial plants, many of which have assured us that they will renew their membership as soon as they resume operations.

STAFF

Since the last Congress the staff of the Council has been reduced from 44 to 30. W. R. Rasmussen, field secretary, resigned to take the position of safety director of the Yellow Cab Company of Chicago, and Carl Smith resigned to accept the position of manager of the Mississippi Valley Division of the National Safety Council at St. Louis.

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REPORT OF COMMITTEE ON SERVICE TO MEMBERS

W. H. CAMERON, CHAIRMAN

Your Committee on Service to Members reports as follows:

Safety Bulletins: During the year the Council prepared and printed 102 bulletins in the general series and 392 sectional bulletins—a total production of 494 original bulletins. The sectional series, for the first time in the history of the Council, have been issued regularly and without a break in the continuity of the service. The quality has improved. The bulletins are still considered by the members as the backbone of the Council's service. The headquarters' staff and your Committee have given considerable thought and attention to the need for a change in the methods of distribution. This will be referred to later.

Safe Practices Pamphlets: Eight of these have been distributed in the general series during the year in addition to the Automobile Drivers' Lessons. The monthly service was curtailed during the last half of the year as a measure of economy. The future program includes the distribution of one pamphlet to the entire membership every two months. This service has also continued to improve in scope and thoroughness. The production and worth of these pamphlets still depends upon the constant service of the Safe Practices Conference Committee and the headquarters' engineering staff. In addition to the general pamphlets sent to all members two have been prepared for sections—textile and public utilities—and have been recently distributed.

Library and Information Bureau: If any member has a doubt as to the growth, development and service of the Library and Information Bureau he should write to the secretary and secure a copy of the Librarian's Annual Report. In addition to the preparation of ten exhibits for conventions; answering 2,889 inquiries during the year; writing articles for a dozen magazines and 2,112 letters; attending to the needs of visitors, the work of cataloging, indexing and classifying the material is maintained. With a decreased staff the librarian, Miss Day, still continues to give splendid service.

Film and Lantern Slide Service: This service has been continued. Two hundred and ten films were distributed during the year for periods of from one day to two weeks.

Your Committee wishes to commend to you the work of the Council's officers and engineering staff in initiating, improving and maintaining this service to the members, but it is the co-operation of the membership that makes the bulletins possible. It needs to be said again and again that the Council will function only insofar as its members work together and interchange their accident experiences through the informational service of the Council.

Distribution of Bulletins: Many of the members have complained that they cannot use all of the bulletins sent from week to week. Up to this time it has been impossible for your Executive Committee to give an individual service, but your Committee believes the time has now come when the membership should consider and recommend to the Executive Commit-

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tee a different method of giving each member only the bulletin service that may be useful to him. Many ways have been considered by your committee to accomplish this purpose but one plan that has met with considerable approval is to change the distribution from a weekly to a monthly basis, and to include in the *National Safety News* a sample of every general and sectional bulletin printed by the Council. If such a service could be developed the plan would be to furnish each member with coupon books to equal the quantity of bulletins now distributed under the various scales of membership used. The members under this plan would be permitted to order as many copies of selected bulletins as they desire, and if the supply of coupons becomes exhausted before the expiration of the membership, additional books could be secured through the headquarters of the Council.

REPORT OF THE COMMITTEE ON BUSINESS AND ADMINISTRATION

W. E. Worth, Chairman

The report of the Treasurer submitted to you in the September number of the *National Safety News* portrays the effect of the industrial depression on the National Safety Council. The Committee on Business and Administration, which has as one of its functions the handling of the finances of the Council, foresaw within a short time after the last annual Congress the tendency of business and the necessity for retrenchment, and has kept in very close contact with the administration of your business affairs and finances.

The Council has long served its members at a minimum of cost to them, and we are all familiar with the action taken in Milwaukee last year increasing the dues 33⅓ per cent. This increase in dues should have taken place in 1919 when costs were rapidly rising, but your Executive Committee, hopeful that the peak would soon be reached, deferred action as long as they could and really longer, in the light of present knowledge, than they should, as, for the two years prior to increasing the dues, rising costs of materials and labor had increased our expenses so that they were exceeding the revenue, necessitating drawing upon a reserve which had been built up since the origin of the Council for such emergencies. The drain upon this reserve, due to the increased costs in the years 1919-1920, was so great that it was absolutely necessary to increase the dues, it not being possible to longer serve the members at less than cost. It was hoped that the increase in dues would approximate the increased cost of operation and avoid drawing on the surplus, but, due to the continued increase in costs as late as March of this year and the cancellations of memberships of companies which had suspended operations as a result of the industrial depression which was apparent to all business as early as January, 1921, it has been necessary even this year to draw upon the surplus. It became necessary to effect very drastic retrenchments, one being a straight reduction in wages affecting everyone on the staff from the General Manager down.

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Your Committee has given very close attention to the cost of all items entering into the service to members and has effected such retrenchments as, in its judgment, were justified and would not interfere with the service to members. It is only by these retrenchments and the use of the surplus which had been built up in previous years that we have been enabled, even with the increase in dues, to maintain the standard of service which had heretofore prevailed, and to open the fiscal year on a sound financial basis.

It is with pleasure the Committee reports to you that, in its judgment, we are now on the financial upgrade and will soon be on a very substantial financial footing, and, if the present indications continue, will soon restore to the surplus the amount which it was necessary to withdraw due to the high cost of items as mentioned.

REPORT OF COMMITTEE ON LOCAL DEVELOPMENT AND PUBLIC SAFETY

JOHN A. OARTEL, CHAIRMAN

At the Cleveland Congress in 1919, Mr. David Van Schaack, who was then President of the National Safety Council, said in his annual address, "The local councils are the arteries and veins which carry life giving blood throughout the entire body of the National Safety Movement. They bring the council into direct and intimate touch with its membership, permeate communities with a real safety atmosphere, and spread far and wide a gospel of care for humanity". At that time there were seven local councils with paid secretaries.

At the present time, the number has reached twenty-three, and in addition to these, there are fourteen active locals with voluntary secretaries, extending from the Atlantic to the Pacific Coast, and Mr. Van Schaack's statement has been more than verified by actual demonstration.

The work of the local councils has been developed along three lines, all of which are important and closely related to each other. They are Industrial Safety, Public Safety, and School Safety.

INDUSTRIAL SAFETY

The function of the local council in industrial safety has been to bring the industries together in certain communities for the training of superintendents, safety directors, and foremen by means of lecture courses, round table discussions, and conferences of various kinds. During the past year, ten lecture courses were maintained with an average attendance of four hundred. When we consider that back of these superintendents, supervisors, and foremen are thousands of workmen to whom the safety message is transmitted, we are led to realize that entire communities are being permeated with the spirit of safety. It has come to the knowledge of the writer that in several instances, real reductions of accidents can be traced directly to these lecture courses. In cities where these courses have been conducted for several years, the graduates have formed Safety Clubs and Associations among themselves to keep alive

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the fellowships and contacts formed during the meetings. These bodies have become a very valuable asset to the local councils. In several cities, they make regular plant inspection and render other valuable service.

PUBLIC SAFETY

If the National Safety Council had sufficient funds at its disposal, there is no doubt that it could work up enough public sentiment to form the organization needed to combat the rapidly growing hazard to life and limb on the streets of our cities and on the public highways. It is hoped that the insurance companies, life, accident and automobile may be led to see that money contributed to funds used to promote public safety will yield large returns. It is gratifying to note that in several cities, funds for this purpose have been donated by Chambers of Commerce, and that in other cities, contributions have been made from community chests. In cities where funds have been available, it has been demonstrated beyond the shadow of a doubt that a large percentage of public accidents can be prevented. This has been brought about by the very same methods that have given such excellent results in industry, namely. organization, knowledge of the hazard, charting the causes, interest on the part of those concerned, and the application of sound common sense.

A specific work done by some of the locals and which has been a valuable contribution to public safety, has been the lecture courses for chauffeurs in a number of large cities under the direction and supervision of the local safety councils. These courses have been instrumental in bringing together large numbers of truck and taxicab drivers as well as private chauffeurs and owners of automobiles. The course for chauffeurs has consisted of lectures and instruction in safe driving as well as the mechanism of the car. The bulletin board, so popular in industrial plants as a means for promoting safety, has made its appearance in garages, at filling stations, and elsewhere and is carrying the message of the automobile hazard to those who need it most.

SCHOOL SAFETY

The teaching of safety in the public schools as introduced by Dr. Payne in the City of St. Louis has spread to other communities. Organizations of Safety Scouts, Safety Cadets, and Junior Civic Clubs among the school children are performing the same work in the public schools that safety committees have performed in industrial plants. At least four local managers have started publications that are circulated among the children. These publications contain lists of accidents which have occurred to children in their own city, and by this means, the boys and girls are informed of the frightful waste of young lives which occur on the streets and in the homes. The publication of these lists is bound to have the same effect that the publication of similar lists has had in industry, namely, the knowledge of the death toll will lead to steps to prevent it. Your committee strongly urges the co-operation of the entire membership of the Council in seeking to interest the school authorities

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everywhere. This feature of safety work which ranks second to none in importance will prevent the sacrifice of the lives of thousands of our children as well as send them into industry with at least the rudiments of safety already acquired.

About 50 per cent of the membership of the National Safety Council is located within the jurisdiction of local councils. Each local has its own peculiar problems of finance and administration. These problems must be faced and solved largely by the local manager and his executive committee. There is, however, a relationship that must be maintained between the local council and the national council. With the view of maintaining and cementing this relationship, the executive committee of the National Safety Council appointed during the last year a special committee whose chairman is Mr. R. W. Campbell, the first president of the National Safety Council. The task of this committee was to formulate a plan whereby the National Council would give the most service and help to the local and likewise leave the local free to work out its individual problems. This report will be submitted at the present Congress.

In closing, your committee wishes to thank the staff of the National Safety Council and the local managers for the kindness and co-operation extended during the present year.

REPORT OF THE PUBLICITY COMMITTEE

IRA V. KEPNER, CHAIRMAN

Over 250 columns of daily newspaper clippings, representing direct reprints of material regarding the Ninth Annual Congress, were received up to November 1920.

About the first of the new year, in the interest of economy the news service to daily publications was entirely discontinued—the only exception being the matter of the Safety Lessons for Automobile Drivers; and the news service to trade publications was cut down from a weekly to a monthly basis. However, during the past year the Publicity Department succeeded in getting more articles distributed by big national news services such as the Associated Press, the United Press, and the International News Service than during the previous year. This made it possible for our Publicity Department to cut down materially the direct, but more expensive, news service to individual publications.

Our educational mailing list was also cut down from 167 to 62 leaving only the better class of educational journals, but, notwithstanding the limitations of time and the funds available, the Council this year secured a greater amount of magazine and trade journal publicity than ever before. Among the general magazines which published articles regarding the Council which were prepared at headquarters, or the material for which was supplied by the Publicity Department were: *The Saturday Evening Post*, *The American Magazine*, *The Survey*, *The Literary Digest*, *The American City*, *The Monthly Labor Review*, and *The Nation's Business*.

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By special arrangement with eight trade publications, the Publicity Department secured, without cost, advertising space which would have cost more than $6,000, if purchased at the customary rates of these publications. Through the news service of the Publicity Department, and through arrangements for the exchange of the *National Safety News* with the principal trade journals of the country the affairs of the Council were kept before the readers of approximately 500 trade and technical publications.

The Safety Lessons for Automobile Drivers received publicity in approximately 200 daily newspapers and practically all the automobile club and automobile trade papers. It is worthy of note here that the lessons were released for publication in daily newspapers on condition that they credit the lessons to the National Safety Council, mentioning the co-operative and non-commercial nature of the Council, and by quoting the price of extra copies in quantity or single sets, and that nearly every newspaper which published these lessons fulfilled this condition.

During the year the Publicity Department sent a questionnaire to the 500 daily newspapers and the 600 or more trade publications and general magazines on its mailing list—asking each publication whether or not it desired the Council to continue sending publicity material. While the purpose of this questionnaire was to economize, it was highly gratifying to note that not more than 10 per cent of the publications in either field indicated that they did not care to receive our publicity material.

The *National Safety News* has been one of the Council's greatest mediums for publicity. Because of the development of *National Safety News* from a weekly of ten to twelve editorial pages to a monthly of thirty to thirty-five editorial pages the Publicity Department of necessity devoted 75 per cent or more of its time to editing the Council's magazine and 25 per cent or less to external publicity work—however, the success of both the *National Safety News* and the publicity work of the Council is due to the brilliant manner in which they were handled by the Editor, Mr. Louis Resnick, and the co-operation that he received from the Officers of the Executive Committee, Headquarters Staff, and the members of the Council.

RESOLUTIONS

The following resolutions were reported by the Resolutions Committee and were unanimously adopted:

Whereas, This annual Congress is favored by an exceptional interest and spirit of co-operation upon the part of the officials of the city and state in which the Congress is being held, and

Whereas, This local and state-wide appreciation of the cause of safety is sure to result in a greater conservation of life within the Commonwealth and an incentive for others, therefore, be it

RESOLVED: That a vote of thanks be extended to the City of Boston and the State of Massachusetts, to Mayor Andrew J. Peters and the Police, to Honorable Channing H. Cox and the State Constabulary,

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and all other city and state officials for their interest in and warm welcome to this convention, and

RESOLVED: That a vote of thanks be given to Mr. Howard Coonley, President, Lewis E. MacBrayne, General Manager, and the Massachusetts Safety Council and to Mr. H. P. Potter, President, and the Boston Local Safety Council for their efficient and valuable assistance in the preparation and the holding of this Convention, and be it further

RESOLVED: That a special vote of thanks be also extended to the general office staff of the National Council for its faithful work during the past year.

CHARLES B. SCOTT, Chairman
T. H. CARROW
E. H. FITZGERALD.

The following additional resolutions were reported by the Special Resolutions Committee and were unanimously adopted:

Whereas, the 80,000 accidental deaths and millions of injuries occurring each year on the streets, in our industries, in homes and elsewhere—more than twice the number of all American casualties in the great war—are a blot on our civilization, and

Whereas, National experience has demonstrated that 75 per cent of industrial accidents are preventable; experimental campaigns in seven cities have resulted in the reduction of public accidents by 25 to 40 per cent, and further efforts will undoubtedly result in even greater progress, and

Whereas, The direct economic cost of accidents in industry alone exceeds one billion dollars annually, and greater indirect losses are caused by the curtailment of production and the lowering of morale, therefore be it

RESOLVED: That the National Safety Council at its Tenth Annual Congress in Boston assembled advocates:

1—The safeguarding of all dangerous machinery and places according to methods that have been found practical and effective;

2—The re-designing and reconstruction of factory equipment where necessary and the improvement of dangerous processes for the purpose of removing the accident hazards, and at the same time increasing industrial efficiency and lowering cost;

3—The education of all workmen and their supervisors in safe methods and habits of work;

4—The safety education of all school children, as well as students in our colleges and universities, both for their own safety and to stimulate their interest in the conservation of life and a better citizenry, and

5—The mobilization of all community forces, including city and state safety councils, for intensive and permanent campaigns against accidents of all types.

W. H. CAMERON, Chairman
B. F. TILLSON
C. W. PRICE.

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ELECTION OF DIRECTORS

The report of the Nominating Committee was presented, nominating the following for election as directors:

For terms ending 1924—

C. B. Auel, Manager, Employees' Service Department, Westinghouse Electric & Manufacturing Company, Pittsburgh, Pa.

C. H. Blakemore, Chairman, Safety Commission, Norfolk & Western Railway, Roanoke, Va.

Robert W. Campbell, Chairman Central Safety Committee, Illinois Steel Company, Chicago.

C. B. Connelley, Commissioner, Department of Labor and Industry, Harrisburg, Pa.

A. E. Davidson, President, Chesebro-Whitman Company, New York.

Marcus A. Dow, General Safety Agent, New York Central Lines, New York City.

H. G. Ellerd, Manager, Industrial Relations Department, Armour & Company, Chicago.

D. R. Faries, General Counsel, Automobile Club of Southern California, Los Angeles, Calif.

E. H. Fiesinger, Safety Engineer, Solvay Process Company, Syracuse, N. Y.

P. W. A. Fitzsimmons, President, Michigan Mutual Liability Company, Detroit, Mich.

George T. Fonda, General Supervisor, Employment, Compensation & Welfare, Bethlehem Steel Company, Bethlehem, Pa.

Robert Herdegen, Vice-President & Manager, Dominion Forge & Stamping Company, Ltd., Walkerville, Ont., Canada.

Ira V. Kepner, Safety Supervisor, Pennsylvania Salt Manufacturing Company, Philadelphia, Pa.

Dexter F. Kimball, Dean, Sibley College, Cornell University, Ithaca, N. Y.

Harold A. Ley, President, Fred T. Ley & Company, Springfield, Mass.

R. M. Little, Director of Rehabilitation, State of New York, New York City.

L. L. Miles, President, Louisville Taxicab & Transfer Co., Louisville, Ky.

W. R. Rasmussen, Safety Director, Yellow Cab Company, Chicago.

C. G. Rice, Manager, Associated Bureaus, Pittsburgh Railways Co., Pittsburgh, Pa.

J. A. Robertson, Manager, Camera Works, Eastman Kodak Company, Rochester, N. Y.

L. A. Shoudy, Chief Surgeon, Bethlehem Steel Company, South Bethlehem, Pa.

C. M. Talbert, Vice-President, Deuchler & Talbert, Inc., St. Louis.

G. E. Williamson, Executive Engineer, Strathmore Paper Company, Mittineague, Mass.

R. J. Young, Manager, Department of Safety & Relief, Illinois Steel Company, Chicago, Ill.

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On motion the nominations were closed and the secretary was instructed to cast one ballot for the persons nominated, who were thereupon declared elected directors of the National Safety Council for the terms stated.

SUMMARY OF AMENDMENTS TO BY-LAWS

The president then stated that after a long study of the local council situation by the officers and Executive Committee in general, and in particular by a special committee on local councils consisting of Messrs. R. W. Campbell, W. E. Worth and J. A. Oartel, the special committee had recommended and the Executive Committee had approved certain amendments to the bylaws of the National Safety Council. Secretary S. J. Williams read the following summary of the purpose and effect of these amendments:

(1) To recognize two classes of local organizations—

(a) Local councils such as are now recognized, composed wholly or chiefly of National Safety Council members:

(b) Safety divisions or bureaus of local chambers of commerce or other local organizations which are not now recognized in the bylaws although they have in fact been given recognition by the Executive Committee. It is proposed now formally to recognize such bodies as "affiliated councils".

(2) To give each local or affiliated council the status of a member of the National Safety Council at nominal dues of ten dollars per year, thus permitting the representative of such local to hold office in the National.

(3) To strengthen the bond between the national and local councils by giving the latter representation on the national directorate and Executive Committee, without increasing the size of the committee beyond workable limits, as follows:

(a) Gradually reducing the number of directors at large from 75 to 45 by hereafter electing only fifteen directors each year —not affecting, however, the status of the directors now in office;

(b) Making each sectional chairman a director;

(c) Making the president or other representative of each local or affiliated council a national director;

(d) Changing the Executive Committee to consist of fourteen of the directors at large, seven of the sectional chairmen, seven of the local and affiliated council representatives, and the two latest past presidents, or thirty in all.

(4) To give as much service as possible from the national staff, to the local and affiliated councils, recognizing that such service should be given without charge in cases where the local includes a reasonably large national membership, but should be paid for in part by the local in those localities where there is only a small national membership, the plan being as follows:

(a) To set up an annual charge against each local to cover the

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cost of general service given by the national headquarters serving as a clearing house of local council information;

(b) To add to this the actual cost of any special service requested by the local, such as the time and expenses of field secretaries;

(c) Against these charges, to give each local a credit consisting of a certain percentage of the national dues paid from that district;

(d) The amount and kind of service and the amounts of charges and credits to be worked out and determined by the Board of Directors or Executive Committee, the general idea being that these amounts should be so fixed that there would be no net charge against any local having a reasonably large national membership.

On motion the following amendments to the bylaws of the National Safety Council were then unanimously adopted:

AMENDMENTS TO BY-LAWS OF NATIONAL SAFETY COUNCIL

Amend Article 3, Section 1, by striking out the word "six" before the word "classes" and insert in lieu thereof the word "seven" and by inserting affter the words "active individual members" the following: "local and affiliated council members".

Amend Article 3, Section 2 by inserting therein after the second paragraph reading: "Any such person also a member of a local safety council may be a local member" the following: "local and affiliated councils duly organized and recognized in the manner hereinafter in Article 11 of these by-laws provided shall be eligible to local and affiliated council membership".

Amend Article 3, Section 2 by inserting after the word "associations", third paragraph thereof, the following: "other than local or affiliated councils".

Amend Article 3, Section 3 by inserting therein after the words "admission to membership in the National Safety Council" the following: "other than local or affiliated council memberships".

Amend Article 3, Section 4 by inserting after the paragraph relating to dues of active individual members the following: "the dues of each local or affiliated council shall be ten dollars and shall be paid annually in advance for the year beginning with the date of the annual meeting for the year 1921 in the case of all local and affiliated councils organized and recognized at that date and beginning with the date of its recognition as a local or affiliated council in the case of local and affiliated councils organized and recognized after the date of the annual meeting of 1921."

Amend Article 3, Section 4 by striking out the paragraph reading as follows: "Only active individual members shall be eligible to hold office in the National Safety Council" and insert in lieu thereof the following: "Only active individual members and the President, or the duly designated Director Representative of a local or affiliated council, shall be eligible to hold office in the National Safety Council".

Amend Article 3, Section 4 by inserting therein after the paragraph respecting the rights of and services to be given to active individual members, the following: "Local and affiliated councils, through their presidents or other director representative, shall be entitled to all the rights of the floor at any meeting of the members of the council but shall not be entitled to a vote, and shall receive such service, and upon such terms, as may from time to time be determined upon by resolution of the Board of Directors or Executive Committee."

Amend Article 3, Sections 14 and 15 by inserting after the word "Director" or "Directors", wherever the same appear, the words "at large".

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Amend Article 4, Sections 1, 2, 3, and 4 thereof, by striking out the same and inserting in lieu thereof the following:

ARTICLE 4 DIRECTORS

Section 1. Number and Qualifications:

(A). Number: The Board of Directors shall be composed of three groups, viz:

(a). Forty-five directors at large to be elected by classes in the manner hereinafter provided by the members of the council at the annual meetings

(b). Chairmen of Sections.

(c). The Presidents of Local and Affiliated councils, or other non-paid executive officers, or members of any such local or affiliated councils which shall be designated as their director representatives by such local or affiliated councils respectively in the place and stead of their respective presidents.

(B). Qualifications:

(a). Directors at Large: Active individual members shall be eligible and competent to act as Directors at Large of the Council. If any Director at Large shall cease to be an active individual member his term of office shall forthwith determine and cease.

(b). Sectional Directors: Chairman of sections which shall have been elected as such at the meetings of their respective sections at the time of the annual Congress, provided, such sections shall have held program meetings respectively at such Congress, shall be eligible and competent to act as Sectional Directors. If any Sectional Director shall cease to be an active individual member or a member of the section electing him as such chairman, his term of office shall forthwith determine and cease.

(c). Local and Affiliated Council Directors: The Presidents of Local and Affiliated Councils and any other non-paid officers or members of local and affiliated councils, which shall be designated as their director representatives by such local or affiliated councils respectively in the place and stead of their respective Presidents and holding such office or being so designated at the time of the annual meeting of the council shall be eligible and competent to act as local and affiliated council directors. If any local and affiliated council director shall cease to be a member of such local or affiliated council his term of office shall forthwith determine and cease.

Section 2. General Powers: The Board of Directors shall have general direction of the affairs and activities of the council and in addition to the specific powers conferred on the Board by the constitution and by-laws the Board of Directors shall have general power to do all such things as may be necessary for the interests of the council and not inconsistent with the constitution or by-laws of the council.

Section 3. Classification and Term of Office:

(a). Directors at Large: The Directors at Large shall be divided into three classes each consisting of one-third of the whole number. The directors at large of the first class shall hold office until the first annual election of directors at large following. The directors at large of the second class shall hold office until the second annual election of the directors at large following, and the directors at large of the third class until the third annual election of the directors at large following, and at each annual election the successors to the class of directors at large whose terms expire in that year shall be elected to hold office for three years and until their successors are elected and qualify, so that the term of office of one class of directors at large shall expire in each year. In the event of an increase in the number of directors at large by amendment to the by-laws one-third of the additional directors at large shall be elected for the then unexpired portion of the term of directors at large of the first class: one-third for the unexpired portion of the term of the directors at large of the second class and one-third for the unexpired portion of the term of the directors at large of the third class so that each class of directors at large shall be increased equally.

In the event of a decrease in the number of directors at large by amendment

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to the By-laws at any annual meeting, or subsequent to an annual meeting and prior to the time of the report of the nominating committee appointed to nominate directors at large for election at the following annual meeting, one-third of such decreased number of directors at large shall be elected at the next following annual meeting of members and one-third thereof at each of the two succeeding annual meetings until such reduction in the number of directors at large shall have been thereby accomplished and each class of directors at large shall be decreased equally. Any such decrease made after the report of the nominating committee shall have been made and before the date of the annual meeting following the same shall be deemed to have been made at such following annual meeting.

(b). Sectional and Local and Affiliated Council Directors: Sectional Directors and Local and Affiliated Council Directors holding such office at the time of the annual meeting of Directors at any annual Congress, as hereinabove provided, shall be deemed Sectional Directors and Local and Affiliated Council Directors respectively and shall hold office until the next annual meeting of the council.

Section 4. Vacancies:

(a). Directors at Large. In the case of a vacancy in any class of the group of directors at large through death, resignation, disqualification or other cause, the remaining directors by affirmative vote of a majority of a quorum of the Board of Directors may elect a successor to hold office for the unexpired portion of the term of the director at large whose place shall be vacated and until the election of a successor by the members of the council.

In case of an increase in the number of the directors at large between the annual elections of directors at large, the newly created directorships shall be considered as vacancies and shall be filled forthwith by the Board.

Should the number of directors at large at any time fall below fifteen, then a special meeting of the members shall be called by the President and such number of directors at large shall be elected thereat as may be necessary to restore the Board to its full membership of directors at large.

(b). Sectional Directors: In case of a vacancy in the group of Sectional Directors through death, resignation, disqualification, or other cause, the Vice Chairman of such section shall become his successor to hold office for the unexpired portion of the term of such Sectional Director whose place shall be vacated, or if there be no Vice Chairman, or if such vacancy shall arise in the case of a Vice Chairman so acting as a Sectional Director, the Executive Committee of such section shall elect one of their number to act as Sectional Director of the council and the person so determined upon in any of the manners aforesaid shall serve until the next annual meeting of the Council.

(c). Local and Affiliated Council Directors. In the case of a vacancy in the group of local and affiliated council directors through death, resignation, disqualification, or other cause, the Vice President of such local or affiliated council shall become his successor to hold office for the unexpired term of such local and affiliated council director whose place shall be vacated, or if there be no Vice President, or if such vacancy shall arise in the case of a Vice President so acting as a local and affiliated council director, or such vacancy shall arise in the case of a director representative designated as such by such local or affiliated council, or in case such local or affiliated council shall desire to designate some other of its non-paid executive officers or members as its director representative in the place and stead of such director whose place shall be vacated, the executive committee, or other governing body of such local or affiliated council shall elect one of its non-paid members to act as local and affiliated council director of the council, and the person so determined upon in any of the manners aforesaid shall serve until the next annual meeting of the Council.

If the term of office of a sectional director, or of a local and affiliated council director, as Chairman of a Section or President, or director representative of his local or affiliated council, as the case may be, shall expire during the interim between the annual meetings of the council, he shall continue in office as such director until the next annual meeting of the council, notwithstanding the

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election or designation of a successor to him as such Chairman of a Section or President, or Director representative of a local or affiliated council, unless he shall be otherwise disqualified to act as such director.

Amend Article 4, Section 11 by striking out all thereof and inserting in lieu thereof the following:

Section 11. Election of Executive Committee: At a regular or special meeting of the Board of Directors first held after the annual meeting of members each year the Board shall elect by ballot from their number, in the manner hereinafter provided, the members of the Executive Committee.

Amend Article 5, Section 1 by striking out all thereof and inserting in lieu thereof the following:

Section 1. Number and Qualifications: There shall be an Executive Committee composed of the last two past presidents, fourteen directors at large, seven sectional directors and seven local and affiliated council directors to be elected annually by ballot by the Board of Directors from their own number and respective groups, as above set forth, at the regular or special meetings of the Board of Directors first held after the annual meeting of the council. A majority of the directors present at such meeting shall be necessary for an election. The members of the Executive Committee so elected shall hold office until the next annual meeting of the council.

Amend Article 5, Section 3 by striking out all thereof and inserting in lieu thereof the following:

Section 3. Vacancies: In the case of a vacancy in the Executive Committee through death, resignation, disqualification, or other cause, the remaining members of the executive committee, by an affirmative vote of the majority of a quorum thereof, may elect a successor to such person from the number of directors in the group to which the Executive Committeeman whose place shall be vacated may belong, and the person so elected shall serve until the next annual meeting of the council.

Amend Article 11 by striking out all thereof and inserting in lieu thereof the following:

ARTICLE 11 LOCAL AND AFFILIATED COUNCILS

Section 1. Organization.

(a). Local Councils: Whenever any ten active individual members of the National Safety Council in any geographical district shall so desire they, for the purpose of mutual conference, aid and helpfulness in matters pertaining to the National Safety Council, and for the purpose of better aiding in the general promotion thereof and the cause of industrial and public safety, upon application to the National Safety Council, may be authorized to organize a local council by a majority vote of a quorum of the Executive Committee. Such local council shall be known and designated as "———————— Safety Council (local council of National Safety Council)".

(b). Affiliated Councils: An independent association or organization, or a group or subordinate organization within a primary association or organization, without regard to the question of membership of either its officers or members in the National Safety Council, upon application to the National Safety Council, may be authorized and be recognized as an affiliated council by the majority vote of a quorum of the Executive Committee. Such affiliated council shall be known and designated as "———————— (affiliated with the National Safety Council)".

Section 2. Qualifications for Membership.

(a). Local Councils. Membership in the National Safety Council shall be a prerequisite to active industrial membership in a local council, provided, however, that applications for memberships in both the National Safety Council and the local council may be made at the same time and upon the same form of application.

Suspension, expulsion or resignation of an active industrial member of a local council from the National Safety Council shall at once constitute a suspension,

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expulsion or resignation of such person as an active industrial member, from such local council.

Each local council may establish local, public safety, or other similar classes of memberships without regard to the membership of such members in the National Safety Council and establish such qualifications for such memberships as it may deem expedient.

(b). Affiliated Councils. Membership in the National Safety Coucil shall not be a prerequisite to membership in an affiliated council. Each affiliated council may establish such classes of membership as it may deem expedient, provided, however, that provision is made for a class of membership which shall entitle members of the National Safety Council, located within the geographical territory of such affiliated council, upon the payment of reasonable local dues, to all the privileges, benefits, etc., that the members of such organization may have in such affiliated council.

Section 3. Voting and other rights.

(a). Local Councils. Every member of the National Safety Council, an active industrial member also of a local safety council, shall be entitled to the same number of votes in meetings of such local council as he or it may be entitled to in the National Safety Council. The members of other classes of membership shall be entitled to such voting rights in such local council as it may determine upon.

(b). Affiliated Councils: Each class of membership in an affiliated council may be accorded such voting rights as may be determined upon by such affiliated council provided, however, that the members of the National Safety Council, located within the geographical territory of such affiliated council, which shall have elected to become members of such affiliated council and have paid the dues prescribed therefor by such affiliated council shall have equal voting rights with other classes of members in such affiliated councils, except, however, that such members shall not be entitled to vote for officers of such affiliated council when such officers may be elected or appointed by the primary organization of which such affiliated council may be a subordinate organization.

Section 4. Dues:

(a). Local Council: Membership in a local council shall not relieve a member of such local council from responsibility to the National Safety Council for the dues provided for in these by-laws, but the same shall be paid directly to the National Safety Council. The National Safety Council shall, however, pay or cause to be paid to any local council the amount of the first year's expenses of such local council up to, but not exceeding twenty per cent of the amount of dues paid to the National Safety Council by the active industrial members of such local council which are members of the National Safety Council, but not of those members which are local or service members of the National Safety Council.

Each Local Council in its by-laws may provide for the local council's dues to be charged, assessed and collected from its active industrial members in addition to the dues to be paid by such members to the National Safety Council and may provide for such other dues to be paid by the several classes of membership which it may by its by-laws provide for, and in such amounts as it may deem expedient.

(b). Affiliated Councils: Membership in an affiliated council shall not relieve a member of such affiliated council, also a member of the National Safety Council, from responsibility to the National Safety Council for the dues provided for in these by-laws, but the same shall be paid directly to the National Safety Council. The National Safety Council shall, however, pay, or cause to be paid, to any affiliated council the amount of the first year's expenses of such affiliated council up to, but not exceeding, twenty per cent of the amount of dues paid to the National Safety Council by the members of such affiliated council, which are members of the National Safety Council, but not of those members which are local or service members of the National Safety Council.

Each affiliated council, in its by-laws, may provide for local dues to be

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charged, assessed and collected from the members of the National Safety Council, also members of such affiliated council, in addition to the dues to be paid by such members to the National Safety Council and may also make provision for such other dues to be paid by the several other classes of membership which it may by its by-laws provide for, or in such amounts as it may deem expedient.

Section 5. Financial Relationship to the National Safety Council: Each local or affiliated council shall pay to the National Safety Council, in addition to the annual dues herein provided for, a definite yearly sum as compensation for the general service being rendered to it by the National Safety Council in such amount as, from time to time, may be determined upon by the Board of Directors or Executive Committee and shall also pay to the National Safety Council for special services rendered, provided, however, that against such payments there shall be credited a fixed percentage of the dues paid to the National Safety Council by the members of such local or affiliated council, also members of the National Safety Council, which percentage shall, from time to time, be determined upon and fixed by the Board of Directors or Executive Committee. The Board of Directors or Executive Committee shall determine and fix, from time to time, the amount and character of such general service to be rendered in consideration of the payment of such definite and yearly sum, the amount of such yearly sum to be paid therefor, which may be dependent upon the population of the geographical district of such local or affiliated council or determined in such other manner as may be determined upon by said Board of Directors or Executive Committee, and the time and manner of payment and percentage of National Safety Council dues to be credited as above provided for, if any.

The Board of Directors or Executive Committee shall determine and fix, from time to time, the method of calculating the charges for such special services as may be requested or required by a local or affiliated council. The Executive Committee shall have power to waive the charge for general service against a local or affiliated council during the first year of its existence, but the percentage credit to be allowed any local or affiliated council shall not be allowed such local or affiliated council during the first year of its existence in the event that it receives an amount in excess thereof from the National Safety Council toward the payment of its first year's expenses as hereinabove, in Section 4 of this article, provided for. If, however, such payment toward such first year's expenses shall not have exceeded the percentage credit, if any, to be allowed to such local or affiliated council, then such excess of such percentage credit over the amount so received by it shall be allowed to it. Except as herein provided said percentage credit shall not be payable in cash, but only in service, as hereinabove provided, and any credit balance remaining at the end of the fiscal year of the National Safety Council shall return to the National Safety Council.

Section 6. Supervision: Each local and affiliated council shall be under the supervision and direction of the National Safety Council, acting through its Board of Directors or Executive Committee.

Section 7. Reports to the National Safety Council: Each local and affiliated council, through its proper officers, shall submit to the Executive Committee of the National Safety Council, on or before the 15th day of August in each year an annual report as of the 31st day of July of its proceedings and activities and shall make such other reports as from time to time may be required by said Executive Committee.

Section 8. Management of Affairs: Each local and affiliated council shall, within ninety days after its organization and recognition by the National Safety Council, adopt a constitution and / or by-laws governing its organization, fixing its classes of membership, the amount of dues to be paid by its members and generally regulating the control of its affairs, not inconsistent with the constitution of the National Safety Council or these by-laws, and its constitution and/ or by-laws shall, within said ninety days, be submitted for the approval of the Executive Committee of the National Safety Council with respect to those portions thereof which affect the rights or privileges of the members of the

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National Safety Council therein and its relationship to the National Safety Council and such constitution and / or by-laws shall not become effective until so approved.

Section 9. Withdrawal of Recognition: If a local or affiliated council shall suspend all activities for a period of one year or more, or shall violate or disregard in any respect the constitution of the National Safety Council, or these by-laws, or shall engage in or continue in any practice or activity which shall injure or bring discredit upon the National Safety Council or be inimical to the best interest of the National Safety Council or the safety movement in general, the recognition of such local or affiliated council may be withdrawn by the National Safety Council upon an affirmative vote of a majority of a quorum of the Executive Committee, provided at least one-third of the whole number of the Executive Committee shall vote in the affirmative, and provided the President or other duly accredited representative of such local or affiliated council shall be given an opportunity to appear before the Executive Committee and answer and be heard upon such charge, and provided also that at least fifteen days' notice shall have been given to the President and Secretary of such local or affiliated council of the general nature of said charges and of the time and place of the meeting of the Executive Committee at which such subject is to be considered.

There being no further business the meeting adjourned.

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General Session on Public Safety and Education

September 26, 1921

C. P. TOLMAN, Chairman

Chief Engineer and Chairman of the Manufacturing Committee, National Lead Company, New York City, and President, National Safety Council.

CHAIRMAN TOLMAN: Because of being called to Washington in connection with the conference on unemployment, Mayor Andrew J. Peters could not be here today to preside as was expected.

Instead of Dr. John Withers, Dean, School of Education, University of New York, speaking on "Safety Instruction in Public and Parochial Schools," Dr. E. George Payne will speak on the same subject.

SAFETY INSTRUCTION IN PUBLIC AND PAROCHIAL SCHOOLS

DR. E. GEORGE PAYNE, PRINCIPAL, HARRIS TEACHERS' COLLEGE, ST. LOUIS

I think that many of us look upon the school in the way it existed in the latter part of the nineteenth century and as it exists in some out-of-the-way places at the present time. A great many of us perhaps look upon the child as going stubbornly and unwillingly to a school and to a room presided over by a middle-aged and cadaverous man or woman with large rimmed spectacles; the woman of course with hair combed straight back, and the school room devoid of everything joyous and pleasant in which to teach the three Rs.

MODERN SCHOOL TEACHES LIFE—

Of course those who have been in the modern school room of today viewed a very much different picture. In the first place they saw a modern individual who dressed and looked like other people and who was equipped to adapt the child to the complex life of the community of which he is a part. The school activities partake of the nature of daily activities and of life itself. It is not surprising, therefore, that we would regard as one of the most important functions of the school room the teaching of accident prevention or the teaching of safety, and regard it just as important as the development of health instruction, the develop-

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ment of healthy constitutions and the development of moral characteristics. Who will say that the purpose of the school room should not be to teach the child the control necessary to protect his life in the complex life of our communities, not only on the street but also in industrial life?

That is the viewpoint that we want to get fixed in our minds. We have looked upon the school as serving the function of giving a specific amount of knowledge about various subjects that were taught in the curriculum—arithmetic, geography and subjects of that kind. The fact is, that insofar as we teach those subjects in the school room, they ought to serve some function other than the knowledge of the subject itself. When those material subjects are mastered, they are valuable only insofar as they serve the child in his relation to life and in his activities in life.

—AND THEREFORE MUST TEACH SAFETY

The modern school room not only teaches the things which were taught before but teaches those things for some other purpose. It teaches these subjects with the idea of helping the child to find himself, with reference to his vocation, with reference to his health and with reference to his safety.

If you will keep those fundamental subjects in mind, you have a good beginning for a discussion of the subject of education in accident prevention. This leads me to say at this point that education for accident prevention is not merely a matter in which the public is interested. I should not like to regard accident prevention merely from the aspect of public safety, but would rather regard it from the aspect of the whole safety movement and just as valuable for industrial safety as for public safety.

In most of the states and in very nearly all of the larger cities, we keep the children in school, for the most part, until they are at least sixteen years of age. We have the children coming into the school room and acquiring information and skill to make them more effective in their vocations. Recently we have conceived the necessity of training the children during the period from fourteen to sixteen years of age, so they can adjust themselves to their vocations in a way that will protect their lives.

We are taking the child and developing those controls while he is taking this peroid of training and is not actually in industry itself. We are helping the child to adjust himself to his vocation or work and to protect himself at the same time. Where the child is on the verge of entering into the industrial life of his community, he needs to have that kind of training so that he will be fitted to take care of his life when he does enter industry.

Those of you who are familiar with educational processes are no doubt perfectly aware of how difficult it is to teach an old dog new tricks. The child acquires his fundamental relations to life and to the community during very early years—before he leaves the elementary school period. If he does not acquire those at that time, it is very difficult to teach him later on.

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To be sure, we have made very rapid progress in the development of industrial safety in the plants. The industrial leaders of the country have done a remarkable piece of work in the reduction of accidents in industry. The number of accidents has been positively decreased from year to year but it has been done by bringing every force to bear upon the problem of education in the factory districts and by training the worker to observe very carefully the introduction of safety devices on machinery and also by every other conceivable means.

CHILDHOOD IS TIME TO TEACH SAFETY AND PREPARE FOR ENTRY INTO INDUSTRY

If you had the same problem to deal in with children, it could be done in a much more economical fashion and it could be done much more effectively. When the realization of hazards is firmly established in a child, when he has a knowledge of conditions that are necessary for safety, when he has developed a safety consciousness, he is led to examine the situations with which he comes in contact with reference to safety. While children in elementary schools are not in industry, they are on the verge of industry and should be acquiring the habits which are necessary for their safety in the industrial life in which they enter.

The problem of safety education is one that can be tied up to school activities. We have tried for a number of years to introduce safety into the schools by setting apart a certain period—a minimum amount of time each week for safety instruction. You all know how slow that procedure was. You all know how difficult it was to induce the educational authorities to take hold of the safety movement and to give safety education a place in the school room. Just as soon as you face a school teacher or school superintendent with a request that he give safety instruction a place in the curriculum, he will tell you it is just one of some fifteen subjects that are being pressed upon him and which he is being asked to place in the curriculum. He will tell you that he does not find time for this safety work.

TYING SAFETY UP WITH USUAL SCHOOL STUDIES

It is out of line with education to attempt to develop habits so intimately connected with the life of an individual, in a few minutes set apart each week for this purpose. From the standpoint of the school curriculum, it is an impossibility. You can't put it over in that fashion because you have no way of administering it and no supervision. There is no one to see that the teacher does this work. However, when you make instruction in accident prevention a part of the activities of various school subjects in the curriculum, such as arithmetic, geography, history and all such subjects, you are making it an integral part of the school life of the child. It then becomes a very simple matter to develop safety instruction and I think teachers have lost an enormous amount of time by not having such accident motives to stimulate interest in the school work.

There is nothing that impresses a child so much as the saving of human life. There is nothing so dramatic as an accident. It is some-

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thing that takes hold of the imagination of children in a real, vital way and because of this, serves to stimulate interest in whatever they take hold of.

You are probably aware of the types of problems that were taught a few years ago in our arithmetics. They had no relation to life. There was no consideration given as to whether the problems had any real interest to the life of the child.

I believe Mr. Price made reference this morning to the new arithmetic which has just appeared. In that arithmetic we have the new type of problem. I will read a few to illustrate.

PROBLEMS WITH SAFETY AS WELL AS ARITHMETICAL SIGNIFICANCE

PROBLEM: Three-fourths of all accidental deaths and injuries can be prevented. The United States in 1918 had 22,000 industrial accidental deaths and 500,000 serious injuries. How many unnecessary deaths and accidents occurred in our country in 1918 among industrial workers?

There is a problem which deals with arithmetic and at the same time gives a lot of facts about accident prevention. Then we have a problem based upon Wisconsin's statistics.

PROBLEM: The following table shows the industrial loss in days in Wisconsin in 1915, 1916 and 1917 due to accidents:

Days lost due to death	3,110,000
Days lost due to permanent and partial disability	1,897,700
Days lost due to absence from 1 to 2 weeks	136,373
Days lost due to absence over two weeks	807,485

What was the total loss in wages at an average of $4.00 per day?

What was the average annual loss?

The total loss above is equal to how many years if we count 300 work days equal to one year?

Did the workmen lose anything in addition to their wages?

Do you think many of these accidents were due to careless habits?

When are careless habits formed?

In that problem you have the child considering accident statistics from every point of view and in that way he comes to realize the seriousness of accidents. We might run through others.

PROBLEM: An auto moving at the rate of 15 miles per hour is 60 feet away from a person about to cross the street. Ought the person to take the chance if it requires three seconds to cross the street?

PROBLEM: How far away must the auto in the foregoing problem be in order for a person to cross the street with safety ahead of the machine? Estimate this distance in the hall of your schoolroom or on the playground. Then measure it. How many per cent long or short is your estimate?

By the use of these problems you are going to give the child some actual experience with problems which he comes in contact with every day. The child is going to realize the importance of looking before he crosses the street because when he comes to the street he is going to think how far the auto is from him and at once stops to think about

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whether he will be safe in crossing the street. Here is another problem:

PROBLEM: If each person killed on account of accident in the United States in 1919 were laid on a cot six feet long and these cots were placed end to end, there would be a line of cots 60 miles long. How many accidental deaths were there in the United States in 1919? How many of these deaths were unnecessary?

With problems of this sort you get the accident statistics which are very valuable. Now I would like to have you contrast the problems which I have just read with those which found in a number of arithmetics which were in vogue a few years ago and are quite common even now.

PROBLEMS: I sold one pound of gold for one cent for the first ounce, four cents for the second, sixteen cents for the third, etc. What did I get?

John Jones divided his estate among two sons and three daughters, the latter sharing equally with each other. The younger received $2,200 which was 5/12 of the share of the elder. Whose share was 16/35 of the whole estate. Find the share of each daughter.

A person being asked the hour of day, said, the time past noon is ⅓ of the time from now to midnight. What is the hour?

These problems remind me of some of those which we used to come across in arithmetics, for instance: If a fish's head is four inches long and its tail is twice as long as its head, and its head is half as long as its body is from head to tail, how long is the fish?

Contrast the problems I have just read with those based upon accident prevention where you have data in which children will be interested and with which they should become familiar.

If I had the time, I should be glad to go through every subject and show you how the various subjects can be tied up with safety work.

I have had an opportunity to try out the book from which I have read those problems and the children in schools where this book is used absolutely refuse to use any of the other arithmetics dealing with the other class of problems. They feel that these problems are life problems and the things that they know about. They have their own experiences in the daily life to help solve such problems and they realize that such problems have something of interest whereas the other class have nothing to do with life whatever.

CHILDREN WORK OUT SOLUTION OF ACCIDENT SITUATIONS

In this new plan of teaching safety, the school is responsible to a certain extent for the accidents in the community. That is, the children are given problems of solving accident situations among the children of the school. They are encouraged to form organizations which are to deal with accidents in their own locality.

In a school where the plan has been worked out for almost three and one-half years, we have not lost a day due to accidents to the children. Since the problem was put up to those children the results have been apparent to anybody dealing with accident prevention in the whole city. It is not merely the feeling that accidents should be eliminated from the community that makes it vital, but it is because the children are getting

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the training so that when they go into industry, they organize for the prevention of accidents. They have developed the idea of "no accidents" and when they come together they feel it is their job to insist that safety conditions prevail. I should say that one of the greatest benefits to be derived from safety educational work in the school is the education of the future worker in industry.

Just before I left home, a committee from the manual training shop of the school about which I speak, came to me and asked about making signs to go out on the streets—signs that could be put out in the morning before school opened and brought in when school closed. I immediately called up the directors and they gave us permission to make the signs as part of the manual training activities. I hear the children have formed safety committee or safety scouts and that they take these signs out and place them in the streets requesting automobiles to drive carefully because of the school. Think of that as a method of dealing with accident prevention and coming from the children themselves.

CHILDREN'S DEATHS CUT FROM 40 TO 2 IN ST. LOUIS

The most remarkable result achieved in my city, St. Louis, is the reduction of school accidents. This problem is being worked out in Detroit and other cities but I am more familiar with what has been accomplished in St. Louis. For ten years previous to 1920 when our plan was first put in operation throughout the city, we had an average of fifty deaths per year to school children between the ages of six and sixteen. In the year 1920 when our plan was first put into operation, we came out with only twenty deaths of school children between those ages. In the years 1917, 1918 and 1919 we had forty deaths from public utilities and about one thousand of more or less serious accidents. In the year 1920 we had two such deaths.

What are we going to do about educational accident prevention? There is no question at all but what this work is a new movement and a new aspect of education and therefore the teachers take hold of it reluctantly. They feel it is going to be a new burden for them with an already overcrowded curriculum. I have pointed out one way in which that may be done effectively and as a regular part of the course of instruction but it becomes necessary for those who are most familiar with the possibilities of accident prevention, people like you who are assembled here today, to go back to your communities and say to your school people, "We know that accident prevention in educational work produces results. We know it and when you understand it you will not let go of the opportunity you have of vitalizing the work. You may use any plan you choose, but you must, as a school organization, undertake that great work, not merely for humanitarian purposes but for the general welfare and protection of educational work in our community."

I think that is why we have made such rapid progress in the last two years, because each year a number of people from the Safety Congress have gone back to their various sections of the country with the idea that education in accident prevention is feasible and that it is a means

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of reducing a great many accidents in communities, not only to children but to adults.

Think of the possibilities you have when you get back to your various communities. I have no fixed or pet scheme that should be used, but I believe instruction in accident prevention should be made a part of every subject in the curriculum.

SAFETY INSTRUCTION REACHES PARENTS THROUGH CHILDREN

This instruction reaches the parents through the child. I do not need to tell you how deeply interested the parents become in educational accident prevention when it is carried on in this way in the school room. A number of mothers and fathers have come to the schools where they are doing this kind of work to find out what it was all about and they have found out what relation it has to their lives. This indicates the extent to which this work can be carried on and the effect that it can have on the lives of adults as well as children.

There has been a wonderful development of educational work in this country. In the year 1850 the wealth of the United States was around seven billion dollars. In the year 1900, although the population increased only sixty-six millions, the wealth increased more than twenty times, so we had around two hundred and fifty billions of wealth in the United States. With that enormous increase in wealth, there has been a great increase in the complexity of situations which produce hazards. It has not only been true in industry, but is true of the streets and homes. During that period we have been concerned more with the accumulation of wealth than we have with the protection of life, therefore the loss of life has been immense.

I should like to call your attention to what a famous economist of the last century said with reference to the relationship of wealth and life, when he saw what was coming in the enormous accumulation of wealth with a growing disregard for human life. He called the attention of the people of that age to the situation with these words:

"There is no wealth but life—life including all its powers of love and admiration and joy. He that is wealthiest is he who has made happy the greatest number of useful human beings. That individual is wealthiest who has perfected the functions of his own life to the utmost possible security and for the widest possible influence, and by this means he has possession over the lives of others."

CHAIRMAN TOLMAN: It is now my great pleasure to introduce the Honorable John Cole, State Commissioner of Public Works, who will speak on Public Safety.

PUBLIC SAFETY

HON. JOHN COLE, STATE COMMISSIONER OF PUBLIC WORKS, COMMONWEALTH OF MASSACHUSETTS

I want to congratulate you on having your safety meeting in Massachusetts this year, for you are meeting in the state which established

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the first safety zone that was ever established on this continent, when the Pilgrims landed at Plymouth.

I am here as Commissioner of Public Works, to give you the relation of the transportation problem of Massachusetts to this safety work. There is no question but what conditions have improved in the transportation field year by year. The railroads, the street railways and other forms of transportation have all contributed not only to give transportation to persons or cargoes of freight from one point to another, but to carry them just a little better and a little safer than they did the day before. It has taken time to develop many of the things which have been brought about in street railway organization and to bring safety conditions and transportation up to the point in which you people are so particularly interested, and that leads us to the latest problem in transportation in which people are interested at the present time—highway transportation. By the development of transportation from highways and horse driven vehicles through railroads, street railways, and the other various means associated with that development, down to the highway again but now with the modern automobile, we have gone from individual service back again to individual service, and that is one of the most striking reasons why so many people are injured in accidents today and why there is need of safety devices and safety councils to bring about safer travel. The responsibility for safety has been multiplied today by millions of individuals and it makes a tremendous problem. Nearly sixty per cent of the travel that goes from point to point is taken away from the protection which an organized railroad or street railway gives to travelers and this is put upon irresponsible individuals who use the highways.

ALL STATES SHOULD AGREE ON TRAFFIC RULES

One of the first things is to have all the states agree on rules. When a traveler leaves one town and goes into another, there should be a general accepted right of way established. In Massachusetts we have followed Connecticut. I give a great deal of credit to that state for having worked out its problem much better than any state in the United States. The right of way in Massachusetts for motorists makes it clear when a man must proceed and the other man must stop, or when he must stop and the other man proceeds. That is something that could easily be established if we could get a co-operative arrangement by all the authorities in the states and get them working together.

Then there is the development of lighting conditions. We have taken that up in Massachusetts and we believe we have established the best code of lighting that has yet been worked out. It is not perfect, to be sure, and probably it is impossible to make it so, as long as the human element is a part, but it has improved conditions very much. Another uniform condition which must be developed is the speed of trucks. The uniform speed at which a truck can run is entirely distinct from the control which should be exercised over the automobile as a pleasure car from the standpoint of speed. This brings us to the problem of making the

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highway safe from the point of surface wear and it is a problem all over the United States. We have got to limit the weight of trucks; if we don't, there is not money enough in the United States to pay the bill for unrestricted carrying on of freight business by motor vehicles.

A sharp distinction should be drawn between a good road and a safe road. I know of hundreds of miles of roads in New England which are good roads but probably not more than half are safe roads. A good road sixteen feet wide carries two lines of traffic, but in order to properly protect it we are today building a soft shoulder three feet on either side. The soft shoulder has probably cost almost as many lives in the last five years in New England as have been sacrificed through the failure of towns to eliminate grade crossings.

When the shoulder gets away from the highway, it becomes a bump and that bump soon becomes a slump and with rapidly moving vehicles there is apt to be a serious accident. A case in my own family can illustrate this, where two lives were lost when the quickly moving automobile was thrown on its side by the slump and overturned.

RECKLESSNESS A THING APART FROM SPEED

I have come to the conclusion that the control of motor traffic in this country is not largely a matter of speed. As a matter of fact, the speed at which an automobile is traveling is one of the least factors in the matter of real safety. It is the man with the head, who has the ability to control the machine, who knows the roads and understands driving that is the real factor. I would not limit speed by law or any other method. I have seen a lot of drivers traveling at fifteen miles an hour who ought to be in jail because of their reckless driving, and I have seen a lot of other drivers going sixty miles an hour who should be patted on the back and called masters and given a perfect right to the highways.

There are miles and miles of highways in Massachusetts where everything is right. They are wide and clean and smooth. The corners and curves are protected. But sometimes an unforeseen condition may arise; for instance, the other day an auto came out of a side street where the corners were hidden in foliage and it was hit by an electric car, tossed out to one side and four or five people thrown out like a flash. The entering street had not been properly marked because it was shaded by the foliage and it was impossible for the motorman of the street car or the driver of the automobile to see anything except straight ahead.

There are a great many people who travel over the roads at the present time at great speed and who rip up a hill at breakneck speed without any thought of what may be coming the other way. One of the serious problems that we must confront in the near future is to eliminate some of the very dangerous grades upon the hills and some of the sharp corners. I don't believe you can appreciate what it costs to eliminate curves and corners and make them absolutely safe. I went down to Greenbush the other day and looked over two corners and it will cost $60,000 to make them what we call perfectly safe, by reconstruction and changes which will make it possible for drivers always to see where they are going. That cost can be repeated over and over again throughout Massachusetts.

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We are trying to eliminate corners and to make all of the good roads that we have control of in our department, absolutely safe. We are taking care of the soft shoulders, we are building new corners and making new layouts to take care of dangerous conditions. We are endeavoring to cut away corners where they are obscured by foliage. It is estimated that it will cost the State of Massachusetts, to make good roads safe in the next ten years, about ten millions of dollars.

WHAT MASSACHUSETTS IS DOING TO MAKE ROADS SAFE

Massachusetts is a long way from making travel safe on existing roads. You probably have all been impressed by the marks on the highways as you have traveled along. Some of those, perhaps, have been easy for you to understand and perhaps some have appeared ridiculous to you. Some of them are ridiculous to us, but we are experimenting continuously and we believe we have made wonderful progress. The lines around our corners were first established here and I think they are one of the most efficient means today of keeping a man on his own side.

We are also experimenting with blind corners. We are beginning a system by which signs will indicate that at a point about two hundred yards ahead, a road is entering the highway and that it comes on one particular side. If the road is a cross-road, an arrow will point to the fact and a line will go clear across in such a way that the driver will know that he is nearing a cross-road. We are taking advantage of the work that has been done by street railways in marking danger points. We are establishing a system very much like that in use with some of the street railways where they mark poles with one, two or three bands, each one to represent a type of danger that is ahead. There must be lighting signals at night at a great many places and there are other things which are essential to make driving safe on our highways. In the next ten years, the State of Massachusetts will spend two to three millions of dollars for just those little accessories to safe driving which have no relation to the building of roads.

In Massachusetts no man can drive an automobile unless he has passed an examination. After he has passed that examination he is constantly watched by our department to see that he keeps his machine in shape for safe driving.

I am now going to stop for a few moments, while His Excellency addresses this meeting.

CHAIRMAN TOLMAN: It gives me great pleasure to introduce the governor who has helped make this movement and No Accident Week possible—Governor Cox of Massachusetts.

ADDRESS OF GOVERNOR CHANNING H. COX OF MASSACHUSETTS

GOVERNOR COX: I can hardly do anything more than to say in a formal way (and I hope the people of Massachusetts have already made it evident to you) that we are delighted to have this great convention of the National Safety Council meet with us in Massachusetts.

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During the past summer we have been observing the three hundredth anniversary of the landing of the Pilgrims. It has been our privilege and pleasure to welcome the great conventions as they have been held here in Boston and in Massachusetts, but I am sure that the people of Massachusetts have not been more interested in any gathering of men, than they are in this convention that is assembled here. Its importance has made an appeal to those who are connected with the government of Massachusetts.

You perhaps have been told that you are one of the first great conventions ever to meet and hold its regular sessions in the State House.

We have tried to do something in industry toward the reduction of accidents and we are pleased to feel that we have made progress along that line. As Mr. Cole was pointing out to you when I came in, we are carrying out an intensive campaign to develop ways of avoiding serious accidents caused by automobiles. We realize that too great a number of our citizens are suffering day by day because of needless accidents caused by carelessness and things which could have been avoided.

If there is anything we can do in Massachusetts to protect the lives and safety of our citizens, surely all of us who have any concern with the government, all of us who have any concern with the welfare of the people, desire to put such methods into operation. We are looking to you men and women who are dedicating your endeavors to this work to try and obtain a solution of this great pressing question. We are looking forward to your discussions and your deliberations with hope and the expectation that as the result of your deliberations we may be given some definite tangible thing which can be done here in Massachusetts to protect the lives of our citizens.

It was a source of great satisfaction to me this morning, when I picked up the paper, to see the splendid result of the first day of our No Accident Week. If you do nothing else, you have made a large contribution by coming here and giving us one Sunday when we were not compelled to read in our great metropolitan papers a discouraging list of accidents, almost all of which might have been avoided.

We hope you may be induced to come here year after year and help us in Massachusetts to do everything in our power so that the work in which you are interested may be one of results. We hope that as a result of your deliberations here, the United States as a whole may take a far step along the road of reducing accidents to the lowest minimum possible, so that we in our daily lives, in our associations, in our intercourse and in our employment may eliminate accidents so far as it is humanly possible; so that we may make our lives safer, and so that we may allow strong men and women to continue the enjoyment of all of their powers and functions.

Mr. C. W. Price: We are highly honored by the presence of the governor of this state who thought this subject was of such great importance that he came here to this meeting and gave us his encouragement. He has assisted us greatly in starting this movement. It means a great deal to all of us to have a governor recognize this movement and grant us the privilege of holding this convention in the State Capitol.

I will now give Mr. Cole the floor.

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TWO TO THREE MILLIONS A YEAR TO MAKE MASSACHUSETTS ROADS SAFE

MR. JOHN P. COLE: May I just review briefly the enormous expenditures which Massachusetts and all other states are making at the present time to make highways safe. Undoubtedly for that job alone, it will cost this state from two to three millions of dollars per year. Then it is necessary to make laws, rules, and regulations for the man who operates vehicles so he will understand the seriousness of driving his vehicles over the highways.

After all, after we make these enormous expenditures of money to build safe highways, after we have all the laws and regulations possible to make, there is still left the individual's responsibility. I don't think there is anything so detrimental to safety as the individual who is careless about operating his car, who gets into avoidable accidents and who operates along the roads without any respect or recognition of the laws and regulations enacted for the protection of lives and property. When we get up to him it seems that this whole proposition must be one of educating the public thoroughly to understand their dangers and how to meet them. There is no question about the importance of working out some scheme which will require that every man who operates a motor vehicle shall be as much a factor in protecting life as the public carriers.

That is not all. The real thing is to educate the people. Let the schools teach the children as far as possible the seriousness of living in the present age where they are part of a rapidly moving circle. After we teach the children, let us get after the older persons. Conditions have changed so that it is absolutely imperative and a rule of the road that traffic in the large cities shall move fast, not slow.

This is a responsibility for which the state can take no part, for which organizations such as yours can take no part, because it depends upon the individuals themselves.

I hope that you men and women may achieve results which will make travel a little safer on our highways and make for better conditions in our workshops and everywhere that our citizens may be found, because it will mean that men better understand the problem of living in the present age of swift moving things.

MR. C. W. PRICE: I wish to thank Commissioner Cole for giving us such an interesting talk.

I have in mind, going back to the remarks of the first speaker for a few moments—Dr. Payne. I think you are now convinced, (if you were not already convinced) that you can go back to your homes equipped with some information and arguments which will enable you to go to your various boards of education and interest them in the introduction of safety instruction in the schools.

I have been making a canvass of towns to find out how many had safety instruction in the schools and to my great surprise, there is more than fifty per cent, according to the replies from cities of twenty-five thousand or more people. That has really been done in the last two years.

ADJOURNMENT.

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General Round Table

September 27, 1921

THE SAFETY BULLETIN

GEO. T. FONDA, Chairman
Manager, Safety and Compensation Division, Bethlehem Steel Company, Bethlehem, Pa.

CHAIRMAN FONDA: We will first take up "The Ideal Safety Bulletin." I will call on Mr. Thompson, of the Eastman Kodak Company, to give us his ideas on the subject.

MR. C. H. THOMPSON (Eastman Kodak Company, Rochester, N. Y.): We of course use the bulletins of the National Safety Council and also get out a good many printed bulletins of our own. We have found that the employee is more interested in bulletins showing local conditions, showing places and people that he knows, than in bulletins that come from the outside. In the preparation of our home-made bulletins we aim at two things: first, to provide good paper and have the bulletins well printed—flimsy bulletins get flimsy results; second, we use as few words as possible. We issue bulletins only when we have a real message to give our employees. We don't put up bulletins just to fill the bulletin board; rather than put up "piffle," I would leave the bulletin board empty for a while; then when another bulletin is put up, it attracts all the more attention.

"ANTAGONISTIC" BULLETINS

Another important thing to bear in mind in the preparation of home-made safety bulletins is to avoid antagonisms. For example, some time ago I saw a bulletin which contained a photograph of a sign put up in certain plants, reading, "This is the dirtiest place in the plant," I don't approve of such bulletins. We would do it this way; we would pick the cleanest department in the plant and put up a sign reading, "This is the cleanest department in the plant." Our assumption is that the men from the dirty departments, seeing this sign, would be more likely to clean up their own departments than if they were held up to shame in the eyes of others.

We print now and then a bulletin carrying a photograph of one of our oldest employees who has made an unusual safety record, together with the story of his record. We find giving credit to the old employee who has had no accident, makes very good bulletin material.

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When business returns to normal, new men will come in, and, as the new man is most easily hurt, we are preparing for him.

CHAIRMAN FONDA: I would like to hear from someone regarding the use of simpler home-made bulletins, that is, bulletins with typewriting and possibly handwriting on them.

MR. H. J. ALDRICH (Spencer Kellogg & Sons, Buffalo, N. Y.): In our plant we are having very good success with bulletins showing photographs of a man or a machine or a place where something has happened. We put under the photograph a typewritten statement telling just what has happened and how it might have been averted. I think this type of bulletin is most effective. Incidentally, I want to disagree with the preceding speaker in regard to the advisability of putting up on a safety bulletin board so-called objectionable bulletins. Let me cite an instance in our own plant where the use of a bulletin of the type objected to by Mr. Thompson accomplished what nothing else could. We tried in every way to get the men to keep the one locker room, that was always dirty, clean, but failed. Then, when we could think of nothing else to do, we took a photograph of the place and used it as a bulletin, with this statement: "This place looks like a hog-pen." It worked; the place was cleaned up and kept clean thereafter.

MR. H. L. ROBINSON (Crompton & Knowles Loom Works, Worcester, Mass.): We have had a good deal of success with bulletins made of blueprints showing the right and wrong way, illustrated with photographs. Another good idea for home-made plant bulletins is to have the plant cartoonist draw a safety bulletin and then have photostat copies made of it.

ADVERTISING PRINCIPLES APPLIED TO SAFETY BULLETINS

MR. ROY BONSIB (Standard Oil Company, Bayonne, N. J.): In preparing blueprint bulletins, if you will spray them with shellac, you will find that they hold much more nicely.

I would like to see safety men give more attention in the preparation of bulletins to the principles of advertising: first catch the attention, hold it; then create desire. By all means study the fundamentals of advertising and apply them to your safety work.

MR. SIDNEY J. WILLIAMS (Secretary, National Safety Council): I would like to ask whether any of the safety men here are getting help in the preparation of their bulletins from the advertising departments of their companies.

MR. THOMPSON: All our bulletins are censored by our advertising department.

CHAIRMAN FONDA: To get back to the matter of housecleaning in industrial plants, we solved this problem by posting home-made bulletins showing the conditions in the various departments. This started a competition; men in one department, of their own accord, began to clean house. We found that the photographs of clean departments set the example; in other words, our policy is to show the positive rather than to knock.

MR. J. R. MULLIGAN (Bethlehem Steel Company, Bethlehem, Pa.): A good plan is to get up your home-made bulletins when the accident against

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which you are driving is fresh in mind, in order to get the maximum results. Another good idea is to group similar hazards that have occurred in a certain period, say, during a year; have photographs taken to show these accidents; or group your hazards by departments, and above all write your bulletins in the shop vernacular.

CHAIRMAN FONDA: I would now like to hear some one discuss the third topic, "How to Use Bulletins Effectively." Will you tell us what you do, Mr. Webber?

MR. H. M. WEBBER (Illinois Bell Telephone Company, Chicago, Ill.): We issue monthly calendar blotters which are sent to our employees' homes in their pay envelopes, and each month we mark some particular date with a red circle and play up some special feature in connection with that date in the text of this blotter bulletin. For instance, this month we marked October 9th, Fire Prevention Day, and gave our employees a little talk on the necessity for fire prevention.

We use both our own and National Safety Council bulletins. There are some conditions that can be pictured only by home-made bulletins. When we use National Safety Council bulletins, we don't attempt to change them in any way, in fact, we like to put on our bulletin boards bulletins mentioning other companies, because we feel that such bulletins show our men that our company is not the only one "crazy on the subject of safety."

For some time we had a good deal of difficulty in getting safety bulletins properly posted in sub-stations and investigation showed a rather muddled condition—all sorts of bulletins and notices posted indiscriminately on boards—no attempt made to take down old bulletins, and various other types of neglect. To overcome this difficulty, we appointed a man in each exchange, whose duty it is to keep the boards in good condition. We also found this to be effective: We sent to each sub-station a bulletin showing two photographs: one of a neat safety bulletin board; another a very shabbily kept board. The copy read: "Which do you prefer?" The result was that our boards are now in a much better condition.

SENDING THE BULLETINS TO WORKMEN'S HOMES

Very often we send to each employee's home in the pay envelope a copy of the same bulletin that we put on the bulletin board, and we also print especially good bulletins in our plant organ, *The Bell Telephone News* at the same time that the bulletin is being posted on the board and sent to employees' homes.

Our reason for sending bulletins to workmen's homes is that we believe the blotter or bulletin will be brought to the man's attention by his wife or child. Very often it is waiting for him at his plate at the supper table.

MR. THOMAS HUBERT (Commonwealth Steel Company, Granite City, Ill.): Right after an accident has happened, we hop out and get a photograph. In that way we carry out the idea suggested by an earlier speaker, of hammering away at a particular type of accident when it is still fresh in the minds of the men.

Recently we posted a photograph of some chips from a mushroomed

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chisel, and we asked the question, "What are they and where are they from?" We offered a prize of $1.00 for the best answer.

I am sure that everyone here would be surprised at the number and kinds of answers we received.

Our plan is to put a plant bulletin in the center and National Safety Council bulletins around it.

USE OF NATIONAL SAFETY COUNCIL BULLETINS

MR. J. M. EATON (Libby, McNeill & Libby, Chicago, Ill.): When we see a National Safety Council bulletin that applies especially to the hazards in one of our plants, we order fifty or more copies of it and hold it at the general office until another accident of that type happens, and then we shoot the fifty copies to the plant that has had the accident, and we ask the superintendent not only to post them on the bulletin boards but to hand them out to the men in the department involved. I can best describe the success of this plan by telling you that in nearly every case the superintendent writes us, "Send me some more of those bulletins—that's fine stuff!"

MR. WALTER KING (Julius King Optical Company, New York City): The bulletin board affords an opportunity to get to the workmen in an intimate way. You must talk to them in their own language. The plant can't talk to the men that way and we can't talk to them that way, but you can create a plant character, such as our own "Larry"; he can talk to the men in their own language.

Mr. W. H. Cameron, Chairman of the National Safety Council Committee on Service to Members, and Mr. S. J. Williams, Secretary of the National Safety Council, then explained the proposed plan for improving the bulletin service of the Council by printing samples of all bulletins in the *National Safety News* and furnishing each member with a coupon book with which to order additional copies of the bulletins desired. After discussion a vote was taken, showing a large majority in favor of the new plan.

ADJOURNMENT.

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General Session: Engineering and Safety

(Under the Auspices of the Engineering Section)

September 28, 1921

B. F. TILLSON, Chairman
Assistant Superintendent, New Jersey Zinc Company, Franklin, N. J.

MR. B. F. TILLSON, Vice-Chairman, Engineering Section, presided and introduced Mr. L. P. Alford.

INCREASED PRODUCTION THROUGH ACCIDENT PREVENTION

L. P. ALFORD, EDITOR, *Management Engineering*, MEMBER, COMMITTEE ON ELIMINATION OF WASTE IN INDUSTRY OF THE AMERICAN ENGINEERING COUNCIL

With the change in business and industrial conditions from those which prevailed a year ago to those which we face today, has come a shifting of emphasis in regard to production.

In 1920 the demand was maximum production.

In 1921 the need is increased unit production—per man, per machine, or per interval of time.

The attack which has been made on this problem during this year in a way to attract nation-wide attention has had for its watchword the elimination of waste. The effort had its rise in the newly formed over-arching American engineering organization, the Federated American Engineering Societies, and its governing body, The American Engineering Council. This body came into being in November of last year, and honored itself by electing Herbert Hoover its first president. One of his first acts was to appoint a committee of eighteen engineers, known as The Committee on Elimination of Waste in Industry. This group attacked a new field of investigation in which there were few precedents for their work. However, between January 12 and July 16 the field studies were made, the statistical investigations completed, and the final report written and approved. Throughout the findings of that report are a group of strong declarations in regard to the waste in American industry which has its causes and sources in accident and ill health,

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and a group of recommendations for their elimination or lessening as one of the great steps in increasing unit production in industry.

This paper is framed largely around the matter contained in that report which will shortly be available in printed form.

Before considering details, that is the estimates of industrial loss due to accidents and ill health, and the remedies that may be applied, it is wise to bring about a meeting of minds as to just what is meant by the term "waste in industry."

A. L. DeLeeuw defines it as "That part of expended material or effort which *could have been*, but *was not* utilized."[1]

The Committee's definition is this:

"No attempt has been made to write an academic definition of waste or to speculate in regard to ultimate savings. For the purpose of this report no attempt has been made to consider all economic wastes. Rather, in the committee's investigations industrial waste has been thought of as that part of the material, time and human effort expended in production represented by the difference between the average attainments on one hand and the performance actually attained on the other as revealed by the detailed reports. In assaying waste in industry the committee has undertaken to evaluate this difference. Thus it has established no theoretical standard of performance or excellence, but has developed a method of measurement to determine the degree of effective use of those factors within which it is believed waste might be discovered. It has conceived that a given practice is not wasteful until a better has been revealed, and that the value of a newer practice, or the amount by which it is an improvement over an earlier one, can be determined only by units and methods of measurement."

These statements present a thoroughly concrete practical point of view. No attempt has been made to reach the ultimate or even a theoretical standard. All that has been done is to measure average performance against that which is known to be possible because it has been actually accomplished.

The result of the studies made in keeping with the principle of this definition revealed four aspects of waste in industry.

Waste in industry is attributable to:

1. Low production caused by faulty management of materials, plant, equipment and men.
2. Interrupted production, resulting from idle men, idle materials, idle plants, idle equipment.
3. Restricted production intentionally caused by owners, management or labor.
4. Lost production caused by ill health, physical defects and industrial accidents.

The striking word in this fourfold group is "management." The reason for this is seen from a consideration of the relative responsibilities of management, labor, and the public. The field studies which were conducted in six industries, namely: men's clothing manufacturing, building, printing, boot and shoe manufacturing, metal trades, and textile manu-

[1]Management Engineering, Volume I, page 141.

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facturing were conducted from a prearranged plan to permit of evaluating quantitatively the relative responsibility of these three groups. A point system was used which gave the following table:

	Responsibility[3] Assayed Against Management[2] Points[4]	Responsibility Assayed Against Labor Points	Responsibility[3] Assayed Against Outside Contacts (the public, trade relationships, and other factors) Points	Total Points
Men's Clothing Manufacturing	48.33	10.50	4.95	63.78
Building Industry	34.30	11.30	7.40	53.00
Printing	36.36	16.25	5.00	57.61
Boot and Shoe Manufacturing	30.25	4.85	5.83	40.93
Metal Trades	23.23	2.55	2.88	28.66
Textile Manufacturing	24.70	4.70	19.80	49.20

[2]The term "management" as used in this part of the report refers to the agency owners or managers) which exercises the management function in industry. This function is defined in a report approved by the management division of the American Society of Mechanical Engineers as:

Management is the art and science of preparing, organizing and directing human effort applied to control the forces and to utilize the materials of nature for the benefit of man.

[3]The "responsibility" of a given agency as here used does not mean moral responsibility as ordinarily understood, but only that responsibility which arises from the undeniable fact that a given cause of waste can be removed only by a particular agency. "We measure responsibility not by the thing done but by the opportunities which people have had of knowing better or worse."

[4]The relative responsibilities have been evaluated in "points." A theoretical total of 100 points represents all possible waste. As no plant is or could be entirely wasteful the number of points assigned in any case must be less than 100.

From the preceding table percentage values were derived for each of the agencies against which responsibility was assayed as follows:

Industry Studied.	Responsibility Assayed Against Management.	Responsibility Against Labor.	Responsibility Assayed Against Outside Contacts (the public, trade relationships, and other factors).
Men's Clothing Manufacturing	75%	18%	9%
Building Industry	65%	21%	14%
Printing	63%	28%	9%
Boot and Shoe Manufacturing	73%	11%	16%
Metal Trades	81%	9%	10%
Textile Manufacturing	50%	10%	40%

A study of the import and meaning of these tables justifies the following statement: Management is responsible for over 50 per cent of the wastes in the 125 plants investigated in six industries; labor is responsible for less than 25 per cent of these wastes.

However, it must not be lost sight of that management cannot eliminate these wastes unless it has the co-operation of labor, although the initiative and leadership must come from those who plan and give orders, that is, from the managerial group.

As we turn to a more specific consideration of the possibilities of increasing unit production through the lessening of accidents and ill health among industrial workers, we must evaluate all of the facts presented and the recommendations made with reference to the relative responsibilities of management and labor.

Three sections of the report on the elimination of waste in industry deal with health and industrial accidents. The latter was written by

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Sidney J. Williams, the one on "Eye Conservation" by Earle B. Fowler, M.D., and the third on "Health of Industrial Workers" by Eugene Lyman Fisk, M.D., and his assistants.

From these reports excerpts are taken to show quantitatively the loss in American industry due to the hazards of injury and ill health.

Accidents in industry may contribute to industrial waste in three ways:

"1. The loss of productive labor on the part of workmen who are killed or injured, together with the cost of medical and surgical attention and the overhead cost in connection with the payment of claims.

"2. The indirect loss of production due to the stoppage or slowing up of work when an accident occurs. This applies not only to the operation at which the man is injured, but also to other operations dependent thereon. It applies also to "near-accidents" in which no personal injury occurs.

"3. The injurious effect of frequent accidents on the morale of workers. Conversely, it may be noted, successful accident prevention work leads to improvement in labor relations."

During 1919 there occurred in all of the industries of the United States about 23,000 fatal accidents, about 575,000 non-fatal accidents causing four weeks or more disability, about 3,000.000 accidents in all causing at least one day's disability.[5]

Lost time resulting from these accidents may be computed as follows:

	Days
Actual time lost in 2,977,000 non-fatal accidents	50,000,000
Loss of future earning power as result of complete or partial permanent disability resulting from 115,000 accidents included in above, equivalent to	108,000,000
Loss of earning power resulting from 23,000 fatal accidents equivalent to	138,000,000
Total	296,000,000

"Experience indicates and authorities agree that 75 per cent of this loss could be avoided. This would mean a saving of one quarter of a billion dollars yearly to employers and a saving of half a billion dollars yearly to employees."

What a tremendous increase in the productive power of industry can be secured by the elimination of this accident waste!

Methods for the prevention of accidents are fully known and are similar in all industries. They represent a combination of two factors: "on the one hand, mechanical and engineering improvements, ranging from a simple gear guard up to the complete redesign of processes and equipment; and on the other hand a definite system of education and supervision not only of workmen but of foremen and superintendents. Experience has shown, not only that the combination of these two factors is necessary for complete success, but further that each increases the value of the other. Improvements in equipment and methods have made

[5]Estimate of F. S. Crum, Assistant Statistician, Prudential Life Insurance Company.

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it possible to obtain a readier response to educational efforts among workmen and foremen; while the educational and supervisory work has led to the invention of safer and better equipment and methods, and the more willing use of the improved equipment which had been provided."

It is impossible to make even an approximate estimate of the saving in money which might be secured by increasing production through accident prevention work. A specific instance in a punch press department was an increase in production from 10 to 100 per cent. In general the limit of saving is the total saving which might be made through the elimination of all stoppages or interruptions of production. Such a saving is impossible except under conditions of skilful management.

There are seven reasons for the stoppage of work, namely: waiting for set-up, lack of help, lack of material, lack of orders, lack of power, repairs, and lack of tools. Accidents are one factor in bringing about the "lack of help."

But whatever the actual percentage increase in production may be, we know that it is a tremendous factor.

It is interesting to note a growing realization of the fact that safe production and maximum production are identical and that each is a managerial responsibility.

C. B. Bartlett, Production Engineer of The Geuder, Paeschke and Frey Company, Milwaukee, in a recent magazine article summed up his own experience on punch press work in this striking statement:

"Of unusual significance was the clear proof during this same period that safe production and maximum production are identical. Everyone from the president and secretary to the last straw boss convinced himself that safe work yielded quantities of good work."[6]

The lessening of accidents is given in a chart which shows a decrease between January, 1920, and August, 1921, of accident frequency from 35 to 10, and in severity from 2.638 to 0.577.

C. B. Auel, Manager of Employees' Service Department, The Westinghouse Electric and Manufacturing Company, in a recently published article, "The Unexpected Trend in Accident Prevention,"[7] gives as his opinion that the most important safety devices which can be installed in the average industrial plant are:

1. Minimum labor turnover
2. Good health
3. Contentment
4. Cleanliness and neatness (personal and plant)
5. Good lighting
6. Prohibition
7. Education (English language at least)
8. Mechanical and equivalent guards
9. Carefulness

Note that of the nine "devices" listed by Mr. Auel only two have a mechanical basis: good lighting and mechanical and equivalent guards.

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[6]Management Engineering, Volume I, Page 170.
[7]Management Engineering, Volume I, page 35.

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For these the management is largely responsible, and yet it is responsible in still greater degree for the other seven.

One section of the Report on Waste suggests the duties and responsibilities respectively of the safety engineer, the controlling safety committee, the foreman and sub-foreman, and the workmen's safety committee. The individual counts number in the order of the agencies listed above—8, 6, 6, and 3. The details are these:

"Duties of the safety engineer:

1. Check up unsafe practices, unsanitary conditions, the use and need of safe-guards, etc.
2. Keep in touch with foremen and secure their co-operation by serving them.
3. Recommend methods of safeguarding and follow up installations.
4. Check all specifications and drawings for new equipment or repairs to see that provision is made for safety.
5. Supervise bulletin board service.
6. Supervise safety educational activities.
7. Arrange programs for safety meetings.
8. Investigate all serious accidents and near-accidents.

"Duties of the central safety committee:

1. Pass on controversial matters.
2. Establish standards for safeguards.
3. Review reports and recommendations of safety engineer, foremen, and workmen.
4. Formulate safety rules.
5. Outline educational methods and direct safety campaigns.
6. Study accident experience tabulated by safety engineer.

"Duties of foremen and sub-foremen:

1. Instruct their men, especially new men.
2. Enforce safety rules with wise discipline.
3. See that tools and machines are kept in proper repair and adjustment.
4. Inspect their departments and render weekly reports.
5. Investigate accidents and near-accidents and recommend methods of prevention.
6. Keep closely in touch with and encourage the workmen's safety committee.

"Duties of the workmen's safety committee:

1. To make regular inspections for unsafe conditions and practices, and submit to the foreman a written report of findings.
2. To instruct and warn fellow workmen regarding dangerous practices.
3. To investigate all serious accidents and near-accidents and submit reports and recommendations.

Inasmuch as one section of the Waste Report deals with eye conservation, it is helpful to present a few of the facts there brought out.

Everyone who has had a contact with industry realizes that there is an appreciable loss through preventable accidents which result in eye

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injuries. The Industrial Commission of Pennsylvania reported that last year (1920) 18 persons lost both eyes in industrial accidents, the compensation totaling $63,731.00; 652 workmen lost one eye, the compensation totaling $826,674.00.[8]

In the United States the total number of industrial blind is approximately 15,000 or 13.5 per cent of the total blind population; this type of injury being the leading causative factor of blindness. Some rather interesting estimates of the cost of maintaining these blind artisans have been compiled, but actual economic loss cannot possibly be estimated. Certainly the personal loss from blindness is far greater to the individual than from other kinds of defect. The eye was involved in 10.6 per cent of all *permanently disabling accidents.*[9]

The possibility of reducing such accidents is shown by the following table from the experience of The American Locomotive Company:

(Yearly Average)	Number accidents requiring medical attention	Number eyes lost	Average number full time men per year employed	Number of injuries per 1,000 full time men per year
1910-13	448	10.5	11,506	38.9
	Use of safety goggles established			
1914	86	1	5,005	17.2
1915	52	2	3,311	15.7

The experience of The American Steel Foundries is that the proportion of eye accidents has been reduced by 85 per cent.

Another part of the eye conservation problem is brought forward by industrial employees who have sub-normal vision. The percentage of these has been determined in several carefully recorded investigations. For example, J. W. Schereschewsky found that in a total of 2,906 garment workers, only 743, or a little over 25 per cent, had bi-lateral normal vision; 17 per cent having normal vision in one eye, with the other defective. The highest percentage of defective vision was in the class of workers who made the greatest use of their eyes. The Life Extension Institute in its examination of more than 10,000 employees in factories and commercial houses found 53 per cent with uncorrected faulty vision. The Institute in its examination of 675 employees in the Underwood Typewriter Company, individuals engaged in close work, found 58 per cent in need of correction by glasses. Schereschewsky is of the opinion that "properly fitted glasses to correct even small defects are, for eye workers, an important part of the hygiene of the eye." An examination of the vision of 3,000 employees of the Robert Gair Company, Brooklyn, N. Y., manufacturers of paper boxes, gave the following results: 22 per cent normal, 38 per cent astigmatic, 28 per cent hyperopic, 7 per cent myopic, and 3 per cent color blind.

"In the Whiting-Davis Company, where a large amount of close fine

[8]Pennsylvania, Department of Labor and Industry, Bureau of Workmen's Compensation, Report, 1920.

[9]Harry Best. The Blind: Their Condition and the Work Being Done for Them in the United States.

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work is done, all the employees' eyes were tested with the following results:

Glasses worn and satisfactory	8.3 per cent
New glasses ordered for	83.3 per cent
No glasses needed	8.4 per cent

"After being fitted with glasses 28 per cent improved productivity was noted in comparing two months. The only thing learned from further statistics is a confirmation of the fact that there are a large number in every group of workers who fall below the line. This is appreciably greater if the number with sub-normal vision in one eye are noted. The Bausch and Lomb Optical Company, Rochester, N. Y., have merely required visual correction without stipulating any individual to carry out the examination. Those dissatisfied with their glasses have reported to one man (Mr. Max Poser) and he reports that more discomfort has resulted when there was a difference between the two eyes, even when one approached the normal, than with two equally defective eyes."

An important factor in improving working conditions which affect the eyes of employees is illumination. There is no question as to the loss of production due to faulty lighting, both natural and artificial. An investigation into 446 plants yielded the following results:[10]

Excellent	8.7 per cent
Good	32.0 per cent
Fair	29.1 per cent
Poor	18.8 per cent
Very poor	3.5 per cent
Partly good, partly poor	7.8 per cent

The requirements for good lighting are simple, and are based on but three points:

1. Light enough to see by to do work—too little or too much producing discomfort.
2. Diffusion to avoid sharp contrasts and deep shadows.
3. Elimination of glare.

The money saved has been amply proved. A very careful study of this, contained in the article by Mr. Auel previously referred to, shows that under average factory conditions good lighting is profitable if it saves even as little as 1½ minutes of time each day for each workman.

The third aspect of this intensely human problem which must be solved to increase unit production deals with the health of industrial workers. The study made for the Committee on Elimination of Waste in Industry was based on consideration of our entire working population for the reason that it seemed impossible to segregate the purely industrial wage earners from all wage earners. An analysis based upon the individuals of the United States, computed from the census records of 1910, adding an assumed increase in population for 1921 gives a total of 42,000,000 workers grouped as follows:

Farm laborers	7,762,000
Farmers	6,846,000
Proprietors and officials	3,150,000

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Professional	2,268,000
Lower salaried	2,646,000
Servants	1,722,000
Industrial wage earners	16,044,000
Unclassified	2,520,000

From numerous sources and investigations the annual loss to wage earners on account of sickness has been set from six to nine days per year.

"Investigations of the United States Commission on Industrial Relations in 1913-15 which cover a survey of the sickness prevalent among approximately a million workers of representative occupations, revealed an average loss to more than 30,000,000 American wage-earners of about nine days per year.

"The Social Insurance Commission of California, reporting in 1917, estimated an average annual loss to wage-earners on account of sickness of six days.

"The Dallas Wage Commission in 1919 estimated an average loss of 6.8 days.

"The Metropolitan Life Insurance Company, through a sickness census of policy-holders and others, people of small means in industrial life, 637,038 white and colored persons, reported loss during the working year as follows: males 6.8 days; females 6.9 days.

"Sickness rates actually determined in recent studies show that 2¼ per cent of wage earners are constantly ill to an extent to be incapacitated.

Turning now to the loss through deaths that are avoidable by the application of known means, we must first consider the death rate of workers:

"The general death rate among those employed at ages from 15 to 65, as estimated on the basis of the industrial insurance mortality experience for the year 1920, was 11.46 per 1,000 living. An estimate of 42,000,000 persons gainfully employed in 1920 is considered conservative. The application of this death rate to such a group would give a total loss for the year 1920 of 428,000 lives and a probable loss in the year 1921 of 500,000 lives."

Without presenting the data upon which the findings are based there is an experimental basis for predicting a saving of four lives per thousand living per annum by the periodic physical examination and instruction of workers. This saving among 42,000,000 industrial workers, yields a total of 168,000 lives which might be saved annually and thereby increase one of the greatest agencies of production—labor.

The opening paragraphs of this paper carried the declaration of responsibility, placing this definitely although unequally upon the shoulders of management, labor and the public. The Waste Report from which this statement was drawn contains a number of recommendations as to remedies that should be applied to lessen wastes. Those which apply to the increasing of production through the elimination or lessening of industrial health and accident hazards are these:

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Responsibility of Management:

Prevention of Accidents.

Management has a definite responsibility to prevent industrial accidents. With regard to methods there is an abundance of information.

Responsibility of Labor:

Improving Health and Reducing Accidents.

Labor is responsible no less than management for improving the health of the workers and for preventing accidents.

Opportunity for Governmental Assistance:

Public Health Policy.

A national policy regarding public health should be accepted and put into effect. The reports dealing with health, prepared in connection with this study by a group of physicians, indicate workers as a factor in production and as a means of eliminating one form of waste. These reports also declare for an aggressive continuous, national public health policy.

Such is the responsibility, such the opportunity for improving, such the tremendous possibility of increasing production through the elimination of the accident and health hazards. But this possibility can never be changed into a reality unless the initiative is taken by management, that is, by the owners, managers, and executives in American industry.

CHAIRMAN TILLSON: I am sure we have all greatly enjoyed Mr. Alford's address, even though he has spurred us on with a challenge, as to our responsibility from the management and executive viewpoint, for a large percentage of accidents that occur in industry.

Mr. John Oartel will now present to us the same topic from a different aspect.

SAFETY AND PRODUCTION, FROM THE PRACTICAL VIEWPOINT

JOHN OARTEL, CHIEF OF SAFETY BUREAU, CARNEGIE STEEL COMPANY, PITTSBURGH, PA.

Several years ago, in a steel mill, they had a pickling process, in which the billets were caught up by an overhead crane with chain slings and put down in a pickling tank containing an acid solution. This process was to take the scale from the billets, before further rolling. The billets were let down into the tank by a crane and a man with a hook in his hand unhooked the chain from the billets. The billets remained in the tank for a certain time for the pickling process. When that was completed the crane came overhead again, chains were let down, the man took the hook and fished through that acid solution, in a blind sort of way, in order to get the chain hooks up, when they were lifted out of the tank again. The chains were put into the acid solution with every lift, and so one of the chains, when they were carrying the load across the mill, broke. One end of the lift was let down, the bars stood

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on end for a moment, and then fell over to where a group of men were working, about twenty-five feet away, killing two of them.

To correct this thing, they put in a syphon arrangement between the two tanks and syphoned the solution from one tank to another, so that when the load was let down, the chains would not enter the solution.

Now, that turned the trick. It kept the chains out of the solution; it kept the chains good and strong; it prevented accident and loss of life, and it expedited the process; because the man could plainly see to hook the chains on the load and didn't have to grope around with a hook any more. Just how much it expedited the process, I don't know, but it helped considerably.

In another plant, where they fabricated splice bars for steel rails for railroads, some of the bars had to be dipped in oil to temper them. This process was at first done by hand; and a man would take up a bundle of splice bars (as many as he could lift with his hands), step over, dip them down into the tank of oil, and take them out again. One cold winter night one of these fellows, after having worked for some time with that oil, got his clothing thoroughly saturated. He went over and stood by a fire to keep warm. His clothing caught fire and he died.

To correct that thing, they installed an endless chain, which is loaded from the crane. No man touches those splice bars now; no man gets any oil on him; there isn't the hazard of that oily clothing—and in addition to that the process is expedited considerably.

We had a paper on the By-Product Coke Hazard in our Metals Section this morning which told about the handling of the coal, from the time it was taken from the barges in the river up to the time it is stored. The statement was made that there were a great many accidents to men who would go down in the barge when it was almost unloaded, to gather up the coal that remained and shovel it into the grab buckets. They were not very serious, but they were accidents. It took sixteen men to go down into the barge, shovel up the coal, and load it into the grab buckets. They designed a grab bucket that now unloads a barge of coal with only about a ton remaining in the bottom, and they get along with sixteen less men on the force, as well as having the process expedited.

So I could go on, with a number of illustrations like that, that have come under my own observation, to prove beyond a shadow of doubt that the things that Mr. Alford has discussed in his charming way, are real things; that we are getting by with them down in the mills; that they are saving life and limb; they are saving money; and they are expediting the process.

CHAIRMAN TILLSON: I think this is a fitting moment to have discussion in regard to the two papers which have been presented, covering the subject of increasing production through accident prevention work. Mr. Alford, I will reiterate, has put the responsibility largely upon the management, and I am glad that he has done so, because it won't do us any harm to assume unto ourselves responsibilities for the causes of accidents. Mr. Alford has quite fittingly drawn the line that management is responsible for the causes, even though occasions may appear to be brought about by carelessness.

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MR. C. P. TOLMAN (National Lead Company): I think most of you have seen the paper in which the inevitable relation between accident and inefficiency is clearly brought out by a purely logical method of reasoning. In this paper is the illustration of an accident causing injury to a man's foot, while trucking materials. The point involved is that when the object falls from the truck and strikes his foot, it indicates an inefficiency; because many times objects had fallen from the truck, before that particular one happend to hit his foot; and undoubtedly the sum total of loss through inefficiency because of the falling of the objects, the breakage of the objects, or at least the delay in trucking operation, would amount to more in dollars and cents than the compensation for the rare foot injury.

The thought leads us to an analogy between accident and industry, and the sensory-nervous system of the human body. The human body, as you know, is one of the most efficient of machines. If it were not for our sensory-nervous system, a man might have acute indigestion and die from it, before he knew anything was the matter with him. He might through a small cut, feeling no pain, bleed to death, before he knew he had an injury. In industry, the painful accident corresponds to the painfulness of the body injury; it is equally an index of an inefficiency.

When an accident occurs it should be examined from two standpoints: first, the prevention of a recurrence of the accident from that cause, if it is possible; second, an analysis of the accident to determine the degree and type of inefficiency which it represents, so that adequate remedial measures can be applied to remedy inefficiency as well as to permit recurrence of the accident.

CHAIRMAN TILLSON: There is no need to introduce to you the next speaker on the program, because you all know him so well. You have elected him the chairman of your section for this coming year.

THE ENGINEERING FACTOR

H. W. FORSTER, INDEPENDENCE BUREAU, PHILADELPHIA

I should like to emphasize to you the importance of the engineering factor. Do I mean by this that on every safety problem only technically trained men should be put to work or that the engineering aspect of safety should be emphasized almost to the exclusion of the educational point of view? Most assuredly I do not. Many of the most successful men in the safety movement have never attended an engineering school except to deliver lectures on accident prevention, and under all conditions educational work is important, and sometimes predominant as in public safety. What I do maintain is that engineering in a broad as well as in a specific way is vital to the achieving of permanent accident prevention in industry and transportation. As I am of the opinion that this is not as generally recognized as it should be, I was glad to take a place upon this program.

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Now as I understand it, real engineering capacity enables a man to attack a safety problem in the following manner:

1—To see the basic hazard.

2—To see the conditions producing this hazard, whether due to equipment, process or worker.

3—To consider the pros and cons of the various methods of eliminating these conditions.

4—To reach a wise conclusion as to the proper procedure.

5—To present the case so that it goes through with the controlling powers.

6—To organize to produce the desired result.

7—To put the proposition through with the co-operation of all parties at interest.

Such capacity to think and plan and do may be applied to feeding a starving people or building a bridge or safeguarding a dangerous process or to any other human problem. That I consider real engineering. It may be a lawyer or a business man or a graduate engineer or a practical safety man who does it; it is not the training of the man that counts; It is the capacity to accomplish. Detailed knowledge of a subject always helps to see a problem clearly. Hence to give proper attention to the engineering factor requires knowledge of safety engineering; no man who is skilled only in educational methods can be expected to do balanced accident prevention work. No safety man should be devoid of knowledge of and interest in safety engineering. A man who is weak in this respect needs the advice as well as co-operation of the engineering talent of his organization. As we well know, every safety engineer needs such support and help; the man who does not have the engineering ability must have it. Unfortunately, it often happens that the man who has the greatest need of help is least prone to ask for it. It is my belief that there is in every industry or transportation organization ample engineering capacity, coupled with the data now available, to solve any safety engineering problem if this capacity is marshalled in the interest of accident prevention.

My first plea is that you believe that you cannot do the best and most lasting accident prevention work by educational methods alone. Under no consideration close your minds to the engineering factor. Only recently a railroad safety man, experienced enough to know better, said that there was no longer any need of safety engineering on the railroads; it was purely an educational problem. All I want to say is that as long as grizzled engine-men climb in and out of locomotives on the type of steps now in use, and signal men in winter weather climb eight inch wide small rung ladders to get at semaphores, and particularly as long as new equipment is just as bad as the old, there is some need at least of the engineering attack in railroad safety.

My second plea is that you men in charge of accident prevention really know what your problem is; that you dig far underneath the surface causes; that you be not satisfied with evidence that seems to indicate that a man was careless or that an accident was unavoidable.

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For every instance where vertigo seizes a man and he falls down stairs or carelessness or horseplay causes a similar accident, there are several cases of inherent defects, such as steep pitch, uneven risers or treads, slipping or tripping hazards, lack of adequate hand rails, dangerous approaches, insufficient lighting, or other defects capable of detection and largely of correction. As I said before, dig for root causes; do not be satisfied with surface indications.

Another important manifestation of sound engineering judgment is the ordering of the problem; establishing a logical plan of procedure. A man who ordered bridge steel without planning for the foundations to be ready ahead of the steel would obviously be incompetent. Similarly we safety men must get a general view of our problem, put down all things we desire to do, and then do first those things that belong first, either because of the importance of the hazard or because a given step is the forerunner of other things to follow or for other sound reasons.

In the early days of accident prevention primary importance was placed on safeguarding, especially of machinery. The educational end was either ignored or else not deemed important. Later when the first statistics of causes of accidents came out, we were startled to find that apparently only a small percentage, generally from 5 per cent to 25 per cent, of all industrial accidents were attributed to lack of mechanical safeguarding; to the lack of safety engineering in the technical or narrow sense. There resulted an almost universal feeling that education was the thing; that engineering was decidedly secondary. Many managements were glad enough to believe this was true, for talk and printer's ink are cheap, and plant arrangement and safeguarding, on the other hand, expensive. It took several years to bring about a changed and correct point of view. The change came from the realization, first, that underlying and not surface causes were the ones at which to strike, that the easy to report and management-from-blame-absolving word "carelessness" frequently covered definite engineering defects, and, second, that an astonishing large portion of the serious accidents and deaths fell in the class where engineering was the fundamental answer. Now frankly, while we want to prevent every slip, stumble, and scratch every trivial accident, would we not much rather prevent one death than a thousand painful hurts—save an eye or a hand rather than prevent a hundred lacerations and bruises? There is only one answer to this question. Let us in analyzing our accident prevention problems then put primary, almost sole, emphasis until that portion of the work is done on the possibility of serious accidents and deaths, and drive ahead along both engineering and educational lines to eliminate or at least reduce them to a minimum. Where are men exposed to danger of falls of some height? Where are the machinery conditions that may mangle and kill? What special hazards of an electrical or chemical character have we in our plants? What burns, asphyxiation, or other real perils do we possess? Having detected these possibilities, in the light of local experience and statistical data, worked out practical solutions to which operating men subscribe, and presented a logical program not too painful

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financially, a safety man is almost certain to get splendid support. Even a relatively callous management, or one which is not particularly prosperous, is hardly likely to side-step responsibility for making improvements when a real menace is outlined. In 1908, when business was decidedly bad, the comptroller of the United States Steel Corporation told me that the only appropriations which it was then possible to get past the management were for safety. And that was before the Steel Corporation knew as clearly as it does today how well intelligent accident prevention pays.

I have been emphasizing the importance of correct analysis and of a logical working plan, and maintaining that the engineering method of attack is essential. Let us now consider one or two of our common problems in the light of the engineering point of view, and let us contrast it with the purely educational one. First let us consider the use of portable ladders.

The educational point of view would emphasize the necessity of using only sound ladders, placing them at safe angles, seeing that they cannot slip, and of climbing them carefully and without any objects in the hand. Every present employee who occasionally does or might climb a ladder, and every new employee, must receive initial and follow up instructions; upon that safety largely depends. What is the engineering method of attack? I should say substantially this:

1—Where and why do men need to use portable ladders?

2—Where can the need of getting at the elevated point be obviated by rearranging equipment or its control, as for example, extension valve handles and the now general practice of using self-oiling bearings and of extending oil and grease cups to already accessible points?

3—How can access to high points that must be reached be secured by extending existing floors, platforms, and walk-ways?

4—Is the "traffic" sufficiently heavy to warrant expenditures of moderate size, first for safety, second for the saving of time, and third to make more certain that essential work will be done as the management expects?

5—Can expenditures for a stairway, for example, be justified in part by the fact that it will serve a purpose other than just the one point under consideration?

6—Are there any special conditions such as fumes, dust, heat, exposure to elements, night use, or need of prompt escape in the event of emergency that warrant an expenditure at first not apparently justified?

7—Where ladders must be used, can they be permanent, and be safeguarded in the various ways in which ample experience has proved practical?

8—If portable ladders must be used, are we buying the kind and type best for our purposes, are they subject to periodic inspections and tests, are they under control all the time, and finally *when used are they carefully used?*

The engineering attack results in a study of plant operations, efficiency, economics, human nature, creature comforts and secures fundamental

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improvement; the advocate of the educational method keeps on saying "you men be careful about those ladders."

If time would allow I could develop many other common problems much in the same way, but I will restrict myself to one more example, that of the control of hand tool accidents.

A certain large corporation employing 3,000 men in one plant had several employees lose eyes through flying portions of tools, and the management admitted that the condition of tools generally was bad. A competent safety engineer submitted a report as to a method of controlling the hazard, but the management decided that the proposition was not feasible or at any rate not advisable. However, after two or more men had lost an eye each it seemed necessary to do something. Then the engineering report, after modifications were made by the local plant men, was put into effect. There was absolute control of every tool at the beginning and end of every shift. Immediate dressing was given every mushroomed head; edged tools had real edges; helves and handles were safely attached and straight; every tool was safe and efficient. An enormous number of tools, many of them forgotten, were collected from all portions of the plant; the time certain men started to work and left was for the first time definitely known; and generally there was sufficient increase in efficiency to pay the entire cost of the tool control. For a period of over a year after this plan of control was put into effect, no eye injuries took place. The accident prevention results were the by-product of efficiency. To show the completeness of control, I may say that the engineer who in the first instance examined tools reported that he looked over some two thousand articles almost all of which were defective or sub-standard. At a subsequent check up examination he saw almost an equal number of tools and he found only four which were not in perfect condition. Here was a concrete case where the management for a long time had been saying to foremen and workers "do not use defective tools". The educational attack got no results; engineering analysis and modern plant control methods did.

Accident prevention involves construction risks, structures of every type, every form of building equipment, handling of materials, sanitation, ventilation, illumination, electricity, chemicals, high temperatures, medical supervision and service; in fact, almost evry phase of modern life has an accident prevention aspect. Even the most cursory consideration must indicate that in a problem so important and varied there is an important place for engineering.

Engineering ability without the whole-hearted support of the entire organization cannot achieve the desired result. This point has been made again and again at our meetings. We know that a successful safety man has to be a popular diplomat, and has often to submerge his own ideas only to let them emerge again through some person who may claim all or most of the credit. Also, that to enlist support, he has to let many a thing go through not just as he wants it. However, the efficiency of a safety department is judged by the results it gets; it is not essential that ideas should originate only with the safety man.

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He may be only the guiding power that puts them into effect. Playing a lone-hand not only fails to get the best results but often proves a losing hand. Another point that we must never forget is that the fewer "showdowns" there are on the authority of the safety department, the better the standing of the department.

A discussion of the engineering factor in accident prevention would be incomplete without specific reference to the consulting phase of the subject. We all know how difficult it is to secure the results that we desire in existing plants; we all known that nothing is easier than to change a pencil sketch or a tracing where new construction or equipment or reconstruction are in the plan stage. A safety man who is really successful will be promptly advised by the management when any important addition or change is due, and his advice will be welcomed by the engineering department. The team-work spirit that has caused the safety man to seek the advice of the engineering department has at the same time given him an opportunity to educate the engineering department so that its work in connection with new construction will be good, and the function of the safety man will be largely to check and approve rather than to fight for the things which are his particular responsibility.

Any man can see a defect if he stumbles upon it; it takes an experienced man to see in his mind's eye the construction, equipment, and operating dangers which may creep into a building or a plant yet unbuilt. It takes real knowledge of one's profession, imagination, and enthusiasm to be successful in the consulting field. It is far and away the most difficult part of accident prevention and the most interesting. Nothing will give a man so great a joy as the approval of his ideas evidenced by their being carried out cheerfully by management, engineers, architects, and contractors.

Men working in the safety field are still confronted by ignorance and prejudice, but more and more the American people are realizing the essential nature of our work. Let us not forget that during the great war rush, when it would seem as though nothing that was not ingrained in our activities could receive attention, accident prevention received its greatest impetus. Let us also rejoice that in these relatively bad times there has been little tendency to discontinue accident prevention work. Most of us have had to curtail our operations, but the same thing has been true of every other phase of industry. I know an organization where virtually the entire sales department has been let out and where accident prevention work still continues.

Let us be truly grateful that we are privileged to work in the field of accident prevention. If there is anything in the theory that worthwhile work is the greatest of blessings, then we men in the safety game are greatly blessed. It is often difficult to realize that our individual effort is a worth while contribution, for results are slow in coming and difficult of proof, and our effort is but one factor in one plant or industry, and we know how far we still are from achieving our desired goal of universal safety. However, when we look back over the great strides

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made in the decade since the National Safety Council was organized, as evidenced by the fact that, whereas the original meeting in Milwaukee hardly created a ripple of public interest, much of New England today is engaged in a great public safety drive, it is clear that while we may very properly feel that our individual contributions have not been what they might, collectively we have achieved much; let that be our inspiration.

CHAIRMAN TILLSON: Mr. Homer Niesz of the Commonwealth Edison Company of Chicago, has agreed to address us on a subject which has been touched upon by both Mr. Forster and Mr. Alford—the question of the true responsibility for accidents—where the causes really lie.

MR. NIESZ: What I shall read to you is not my own product. It is the product of the assistant inspector of safety of the Commonwealth Edison Company, Mr. H. W. Lueck. Whatever there may be of merit in the paper should be credited to him.

AN ANALYSIS OF ACCIDENT CAUSES

H. W. LUECK, ASSISTANT INSPECTOR OF SAFETY, COMMONWEALTH EDISON COMPANY, CHICAGO

In this article is presented a basis for analyzing accidents as to cause, which materially differs from the analysis which for many years has been adopted officially or unofficially as standard. The purpose of this article is to present a list which covers industrial accidents of all types, whether occurring in connection with the operation of a public utility, a steel mill, a mine, or in some other branch of industry.

For years there has been a demand for a means of supplying information to the one in charge of safety work, which will enable him to lay his hand on the causes of accidents, whether these causes be methods, conditions, equipment, or personnel. Without this information a safety supervisor must of necessity work in the dark. The aim of accident statistics has been to fulfill this need but those charged with the responsibility of reducing accidents know only too well that the mark has been missed.

For example we find from the old analysis of accidents that nearly 20 per cent of all accidents occurring in the electrical industry are caused by "handling material". With this information in hand where is the safety supervisor to start in his effort to eliminate this class of accidents? Perhaps some of these accidents are caused by men attempting to lift weights which are beyond their strength to move. If so the primary cause of the accident is an attempt to do a "class of work beyond the ability of injured". Possibly some of these so called "handling material" accidents are caused by "needless haste", "contributory negligence of others", "lack of proper instruction" or one of many other causes. If so, this fundamental cause is the information which a safety supervisor must have in order to effectively combat accidents which under the old system would be buried in a cause such as "handling material".

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For some time, particularly during the past two years, much has been said concerning the need for standardizing accident statistics. Each branch of industry has a classification which differs from the other branches and even within a particular industry there is a lack of uniformity which makes it extremely difficult, if possible at all, to combine statistics. Several committees are working upon this subject of standardization. It is evident that the primary step to be taken by them is to adopt a classification which will be adaptable generally and which will be of most value to the men directing the work of accident prevention.

Statistics obtained from an analysis of accidents which includes any but primary causes is obviously misleading. Secondary or contributory causes should of course receive attention, but there is time for this when the much more important work of controlling the actual causes is well in hand. In the classification presented herewith are twenty-three causes of accidents, each of which is primary in character. Any advantages gained from the use of the classification now in general use are obtainable through the adoption of the one submitted herewith and in addition there are in this classification a number of features which are of decided importance.

1. This classification is, to a certain extent, a tabulated analysis of reasons why the human element fails to function. This is obviously a point in its favor if the statement so often heard and so seldom verified is true that 85 per cent of industrial accidents can be attributed to carelessness and its many subdivisions.

2. Our experience indicates more and more that accidents are largely due to the lack of responsibility on the part of either the workmen injured or his supervisor. If the new classification therefore does nothing but place the responsibility for accidents on the proper parties it has gone a great way toward determining the cause of accidents and pointing out the place where accident prevention work is most needed. This point of placing responsibility properly is a feature of the new classification which cannot be overestimated.

3. Certain deductions must be made from our present classification to indicate whether a group of accidents are being caused by the negligence of the foreman, improper method of operation, improper tools, etc., in order to make it of value. In this one however, these deductions are unnecessary as each of these has its place in the analysis and is covered by a specific item. These are the real causes of our industrial accidents rather than traits of the employees themselves, as one might assume from a casual reading of the list of causes.

4. The fact that the present standard classification is in general use and has been for a number of years, should not be an argument against making a change if we feel that such change would be a decided improvement in our methods. It is felt that an analysis containing only recent accidents would be of more value than continually adding to an analysis which contains accidents which occurred from five to ten years ago under circumstances which do not exist today.

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5. It is a decided advantage to a company to have accidents analyzed according to its particular needs and circumstances rather than to have them conform to a classification which is general in character and which does not comply especially with the company's requirements.

6. Either the present or the new classification should be adopted rather than to attempt to follow both. This would only lead to confusion and would no doubt be a detriment to our analysis work rather than an additional help.

7. The classification presented herewith offers for the first time an opportunity for standardization of causes regardless of the industry involved. Certain modifications or amplifications can be made to adapt this classification to any particular industrial branch but in general form each would consist of the following causes:

ACCIDENT CAUSES

A—Lack of Proper Supervision.

1. Altercations.
2. Class of work beyond ability of injured.
3. Defective tools or devices.
4. Improper tools or devices.
5. Lack of proper instruction.
6. Method pursued not suitable for work.
7. Protective devices not used.
8. Rules not observed.
9. Safety appliances not provided.
10. Defective material.
11. Lack of proper inspection and maintenance.

B—Shortcomings of Workmen.

12. Contributory negligence.
13. Conceit.
14. Intemperance.
15. Lack of concentration.
16. Mechanical manner of doing work.
17. Needless haste.
18. Physical condition of injured.
19. Poor judgment.
20. Stubbornness.
21. Wilful carelessness.

C—Miscellaneous.

22. Elements.
23. Non-industrial.

1. ALTERCATIONS

Whether altercations can correctly be included in a list of accident causes is a question. However, altercations frequently result in injuries, and as the words "injury" and "accident" are commonly if not properly used as though synonymous, this item is one which calls for a place in our analysis.

The prevention of this type of accident like many of the other types

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becomes apparent when the cause is stated. With proper employee relations, injuries resulting from altercations will be nil.

2. CLASS OF WORK BEYOND THE ABILITY OF INJURED

Most men appreciate their own alibity and realize their limitations, but few are content to confine their work within these limits. If a man can lift a 150 lb. weight, he is very apt to attempt one of 200 lbs., although it was with difficulty he handled the first one. The result is too often a strain or hernia. The responsibility for the elimination or reduction of the accidents in this class, rests largely with the management in placing men in the proper place.

3. DEFECTIVE TOOLS OR DEVICES

In former classifications of accidents appeared a cause "handling tools" under which was placed approximately 15 per cent of all accidents. Some of these were no doubt due to the use of improper tools, some to defective tools, some to using tools improperly, or one of many other causes.

The elimination of defective tools and the consequent elimination of accidents resulting therefrom is purely a matter of frequent inspection.

4. IMPROPER TOOLS OR DEVICES

In this classification a distinction is made between defective tools and improper tools. The former item covers accidents which are caused by tools being in poor condition and the latter those accidents which result from using the wrong tool for a certain piece of work, as for example a hand axe for a hammer, or a screw driver for a chisel. As a rule men know better than to use an improper tool, but they do it because the right tool is not handy, or because they or someone else has neglected to order the proper one. Workmen who use, or foremen who tolerate to be used, tools not entirely adaptable to the work should be instructed in this detail.

5. LACK OF PROPER INSTRUCTION

Little blame can be placed upon the employee who is injured while doing his best to perform a piece of work about which he has not received sufficient instruction.

6. METHOD PURSUED NOT SUITABLE FOR WORK

The ever changing conditions and consequent change of methods, sometimes result in methods not being changed promptly, thereby not being in conformity with the work. Workmen as well as supervisors should suggest changes as soon as the old method will not do the work safely. More men are injured and killed by wrong methods than by physical conditions of properties or machinery. This cause is similar to that of "improper tools and devices" with the exception that in this case the improper method is used in place of an improper tool. If this is done in an effort to save time the primary cause is "needless haste" and the

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accident should be classified as such. If it is done because the employee didn't know any better the accident should be charged to "lack of proper instruction".

This item is intended for those accidents which are caused by men following methods which they know to be wrong but which may be adopted because they are less effort or for other insufficient reasons. Education, instruction and enforcement of rules will reduce these accidents.

7. PROTECTIVE DEVICES NOT USED

More accidents are caused by failure to use protective devices than are caused by men not being supplied with these devices. The saying, "A guard out of place is no guard", is an old one but none the less true. Men who neglect to use the appliances which are furnished for their protection are either ignorant of the danger involved or are careless in their habits. Neither of these reasons is sufficient. The first implies a lack of proper instruction (See No. 5) and the latter indicates wilful carelessness (See No. 19). The strict enforcement of proper rules is the solution.

8. RULES NOT OBSERVED

It is often found that where rules are not observed, there is a laxness either in the rules themselves or in the manner in which these rules are brought to the attention of the employees. The first step towards the elimination of these accidents is the preparation and adoption of standard, practical rules. The enforcement of all rules is of course the important point in the prevention of accidents of this type.

9. SAFETY APPLIANCES NOT PROVIDED

This item appears to be one for which the company is responsible. In some cases this is true but very often it is not. A company which is sufficiently interested in accident prevention work to establish a safety department, employ a safety man, and pay the expenses incident to such a department is not very apt to stop when it comes to anything as important as the providing of safety appliances. Many times the fault lies in not reporting the need for such appliances.

10. DEFECTIVE MATERIAL

Material used by the average company is usually the best obtainable. It becomes defective many times, through careless handling and lack of instructions to men in the proper method of installation. All material should be inspected before being used and standards maintained at all times. The immediate reporting of any defective material is of course important and instructions covering this matter should be given.

11. LACK OF PROPER INSPECTION AND MAINTENANCE

Following the completion of any work a competent inspector should check the work giving the item of safety first consideration, other items

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in the order of their importance. All work should be inspected periodically and necessary repairs made. Employees should assist the employer by reporting defective equipment or tools, thereby helping reduce the number of accidents from this cause.

12. CONTRIBUTORY NEGLIGENCE

This cause is one which is wide in scope. No one likes to admit that he has been the cause of an accident to himself, and the tendency is often displayed to lay the blame upon some other person. In a company which has a good safety organization, accidents of this type should be few.

13. CONCEIT

The desire to display one's ability before his fellow workers is occasionally the primary cause of an accident. The operator of a machine usually speeds up as someone approaches, in an effort to display his skill.

14. INTEMPERANCE

Since the enactment of the Eighteenth Amendment, intoxication of workmen has decreased considerably. However, a more sinister evil has crept in, in the form of home brewed wines and whiskey.

15. LACK OF CONCENTRATION

This item although seemingly theoretical is one which is responsible for more accidents than is generally realized. It would be interesting to know the actual number of accidents that occur on account of lack of concentration. Of course, the apparent ones only will be classed under this item but those who are in close contact with the workers have often been confided in following an accident and too often it has been learned that the injured at the time of the accident was thinking of some domestic difficulty, an increase in rent, a doctor's bill or some such worry which is so difficult to remove from one's mind.

16. MECHANICAL MANNER OF DOING WORK

Closely related to the item, "lack of concentration" is this cause, "mechanical manner of doing work". Repetition leads to habit and habit to thoughtlessness and injury. Familiarity with work is not always an asset from the safety viewpoint. The remedy for these accidents lies only within the employee, and is not different from the foregoing item. "Keep your mind on your work" is the answer.

17. NEEDLESS HASTE

In these times when there is an abundance of labor, and when the cry is for speeding up work, the question of haste is a ticklish one to tackle, especially with foremen. Most men are anxious to make a good showing and this cannot be done without the help of those under them. Proper haste is to be commended and rarely results in an accident. It is the

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man who exercises a needless haste; who throws an insulator to the man on the pole in place of sending it up in the tool bag, that causes accidents.

18. PHYSICAL CONDITION OF INJURED

"From the standpoint of the employer"—You would not employ a one eyed man to be your chauffeur because your life would be at stake. It is therefore gross negligence to expect a physically unfit man to work where he might make himself further unfit and also jeopardize the lives of his fellow workmen. "From the standpoint of the employee"—An employee who is physically unfit to do the work required of him should out of respect and regard to his loved ones at home, ask his employer for suitable work. It might mean work with less compensation, but it should be remembered there is a total loss to the man totally disabled.

19. POOR JUDGMENT

Under this cause many accidents have been recorded. It may be a mental condition, or improper education in the particular line in which the worker is employed. This failure should be noted promptly by the foreman and if good judgment cannot be instilled in the man, a change should be made. Examinations in his work will help remedy this condition.

20. STUBBORNNESS

The "bullheaded man" as he is termed is often intelligent but quite conceited. If he is left alone this bad trait might wear off. A good way to help him is to study his ways, his weaknesses and play upon them for results. He is his own worst enemy and needs the counsel and advice of others—not responding to this, he is a menace to his fellow worker.

21. WILFUL CARELESSNESS

The subject of carelessness has been so thoroughly discussed by everyone connected with the work of accident prevention that it is a question whether it has not been overdone. This cause needs no explanation. It covers those accidents caused by the indifferent or reckless worker who was knowingly careless; not the man who was injured through lack of concentration. The remedy is vigilance on the part of the foreman and special attention from him toward instructing and training the man responsible for such an accident. Willful carelessness on the part of an employee should not be tolerated for any length of time and if efforts towards improving him are not effective, he should be disposed of as a means of protecting those with whom he works.

22. ELEMENTS

Less use will be made of this cause than any other in this classification. It is included however to cover those unusual cases which come under the customary phrase "act of God". Occasionally an employee is

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killed by lightning or during a tornado or flood and this item is designed to take care of these isolated cases.

23. NON-INDUSTRIAL

This item has been placed in the classification merely to cover those accidents which occur outside of business hours and not in the regular course of employment. Often a record from the medical department must be accounted for in order to correspond with the statistics of the safety department and it was with this in mind that this heading is included.

MR. CHARLES B. SCOTT (Bureau of Safety, Chicago): I think you can better conceive of the idea presented in the list of causes given here, and the soundness of the doctrine in Mr. Lueck's paper, if you will for a moment review in your mind the history of accident prevention effort. I know it will help you to clear up the situation in your own mind, if you see this history as I do.

In the beginning the chief efforts for accident prevention were directed to the safeguarding of the mechanism, and for a time all efforts were concentrated in that direction. Then came a time, born of experience, when it developed that, that was not all, and a swing was made by all those who were specializing in the work, over to the educational side. All of our Congress proceedings, all of our publicity with regard to safety, were almost entirely devoted to the educational side.

Later, and I think perhaps as recently as two or three years, the pendulum has been swinging back toward more practical considerations and you hear more about supervision and rules and about safety being a matter of efficiency and proper operation of a property.

More and more the safety work is becoming identified and tied up with the operation of the property. Both of the gentlemen who spoke to you from the engineering side emphasized very strongly one statement. That was, that you must get at the fundamental cause of accidents. It is true in so doing, you cannot disregard the educational side. It is true also, that you cannot disregard the mechanical or the human side of the question. It is true that there is a proper ground somewhere between and including both of these.

The object of the analysis presented, I think, can best be illustrated.

Assume that I am the director of safety of a corporation employing a large number of men. In order that the different departments of that organization and the department heads of that organization may have an idea as to what is occurring in their respective departments, I send out to the department heads, each month, an analysis of the accidents which have occurred in particular departments. One man—a superintendent of the department—gets a scorecard and finds that during the month he has had twelve accidents in his department, caused by slips and tripping. He finds that he has had ten accidents due to handling material. He finds that he has had six or eight accidents due to moving machinery, and some more due to nail punctures, or to flying parts, injury to the eye, etc. That is the information I give to the heads of departments in

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order that they may have a proper conception as to what they should do to remedy the accident record in their particular departments. That would be following the standard analysis of accidents used by all the industries.

Suppose on the other hand, forgetting the other analysis, that I take the same group of accidents that are represented in the card just described, and I make another card and hand it to that department head, and he reads that he has six accidents due to lack of proper instruction, two of which resulted in slipping and tripping; perhaps one of which was caused by moving machinery; he finds that he has six accidents caused by disobedience of rules, by attempting to do something beyond one's ability and strength; and so on.

It is needless for me to draw a comparison or to try to explain to you which would be more beneficial to this head of department in regulating the conditions in his department. You all agree with me, I am sure, that he could readily see how he could get at the fundamental basis of the trouble in that department and how he could remedy it.

When this matter was first brought to my attention by the originator, I was not only skeptical, but I thought it was a beautiful theory and didn't mean much. In two weeks I began to get interested in it and lately I have become enthusiastic about it; and although I believe it will have to be modified and refined in a great many ways, I believe the fundamental thought presented by Mr. Lueck's paper and your study of this rather radical departure, will be of great help to you, although it may never become the nationally recognized standard of analysis.

Mr. M. F. Crass (Grasselli Chemical Company, Cleveland): I feel in looking over our statistics in years past that they failed to get down to the root of the matter. There is a tendency to pass the buck to the workmen. There are accidents where there is a division of responsibility—a lack of proper supervision, and also very evident lack of carefulness on the part of the workmen. I would like to know what you would do in such instances.

Mr. Niesz: The intention is to have the man who makes out the accident report, specify on that report the number, indicating the immediate cause of the accident. That would have to be checked up afterwards by the safety inspector or supervisor, to determine whether or not the cause was correctly stated. There may be questions in some accidents as to where the primary cause really lies. It may be stated by the last inspector, "partly due to fault of the management, partly due to fault of the men."

Dr. L. W. Chaney (U. S. Bureau of Labor Statistics, Washington, D. C.): The fundamental difficulty, it seems to me, with this classification is that in a large number of these classes no man living can determine whether an accident was due to that cause or not.

I challenge any of you safety men to determine whether in a given case, the accident was due to the stubbornness of the workman. How are you going to find out whether it belongs in that classification or not? Sprinkled all the way through are these cases of the personal equation.

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You have got to know the man, with an intimacy which you don't even know yourself. If you were to be hurt in a certain way, I doubt a good deal whether you could tell that it was conceit that was the cause of your injury.

MR. SCOTT: If you have a headache, it may be due to tired nerves, or disordered stomach. You say a layman might not be able to determine which. There are doctors who can diagnose your case. It is more important to know whether you have a disordered stomach or tired nerves, than to know whether you have a headache.

DR. CHANEY: I don't know the doctor who can determine the items in this classification. If you will find me the man who can determine them, I am open to conviction, but I don't believe they can be determined with any degree of precision and accuracy.

On this question of intemperance, I spent twelve years in the attempt to find records which would clearly demonstrate that the use of alcoholic liquors was a serious factor in accident occurrence. Now, I know perfectly well that it has been; I may say, that I know that it still is; but to demonstrate that class of accidents as having been caused by the intemperate use of alcohol, was so impossible that I gave it up.

This classification may be very useful; but you ought not to undertake it without understanding the pitfalls that are in it. The fundamental necessity of any statistical study is the ability to determine precisely the item on which you are going to base your statistical study; and the difficulty with this, is that there are some cases in which it is not possible to determine precisely.

The whole question of personal responsibility has been thrashed out in the courts of this and other countries for an indeterminable number of years, without arriving at any result; and the whole development of our system of compensation is getting away from the question of whether the employer or the employee is responsible, and simply treating the accident as an incident of the business; preventing it if you can; taking care of it if you cannot.

(A paper on "Dust Explosions", illustrated by motion pictures, was then given by Mr. David J. Price, Engineer in Charge of Development Work, Bureau of Chemistry, U. S. Department of Agriculture. This paper had already been presented before the Automotive Section and will be found on page 165 of this volume.)

ADJOURNMENT.

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Joint Meeting of Manufacturing Sections

September 29, 1921

C. P. TOLMAN, Chairman

Chief Engineer and Chairman Manufacturing Committee, National Lead Company, New York City, and President, National Safety Council

PRESIDENT TOLMAN: Gentlemen, in past Congresses, it has been suggested that too many subjects of general interest were taken up individually in separate sections, and that it would be possible to bring together in general sessions all of those especially interested in the subject and get better papers and better discussion. That is the purpose of this meeting. The first speaker is Mr. R. W. Shenton.

BETTER INDUSTRIAL LIGHTING—WHY?

R. W. SHENTON, NATIONAL LAMP WORKS, CLEVELAND

The history of artificial lighting is the history of the oldest art practically known to man. Through the thousands of years of history, we have been searching for light, for newer and better light sources. In all of the thousands of years that preceded our own generation, practically no advances were made. Lighting was at a standstill to the extent that the candles used in Solomon's temple were essentially as efficient as those used by George Washington, and practically as efficient as those used in the days when our own grandmothers were young.

During all that period of time, no departure was made from the use of flame as an illuminant; and then practically within the lifetime of all of us came a departure from the use of flame, when Mr. Edison gave to the world the incandescent lamp. Following that new invention, there came increases in efficiency, so that our light source today is something like ten to fifteen times as efficient and a great deal more concentrated than the first lamp that Mr. Edison introduced.

It is significant to recall that when the incandescent lamp was first invented, some of its promoters pointed out, in their enthusiasm, that all that would be necessary would be to run the electric wires through the gas pipes already installed and substitute the new lamp for the gas burner.

That, ladies and gentlemen, has been the history of average lighting practice ever since—substitution.

If our Mazda B lamps, our vacuum lamps, had always been installed in accordance with the best knowledge of the time, and then we had sub-

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stituted the Mazda C lamp, while the results would not have been perfect, they certainly would not have been calamitous. But the use of these high-powered modern illuminants in accordance with coal oil practice, as is the case to an extent greater than we like to admit, is a definite hindrance to the cause of better illumination. The result is that progress in the development of the lamp having been so rapid, we have not kept up in the application of that lamp; and today, instead of corrective effort leading and pointing the way, it is a scramble to catch up.

Fortunately, during the past ten or twelve years, or longer, there has come to be a new profession, a class of men who call themselves illuminating engineers, and who realize that light, after all, is only a raw material which must be harnessed and controlled before illumination results. The illuminating engineer pointed out to us that there is a distinction between light and illumination. He was interested in what happens after the light leaves the lamp up there as candle power and before it registers its impression on the human eye as vision.

When he came to us with his findings, we who class ourselves as practical men were inclined to consider him theoretical, abstract, technical, because in developing this new science he had to bring to us new terms, new units of measurement. Presently he brought along developments, one of which was a simple, compact instrument that enabled us to measure illumination, the foot candle meter. Then he came to us also with results of installing good illumination rather than poor illumination, and it is those results that have given us a new interest in lighting today, an interest which makes us class artificial illumination along with the labor-saving, life-saving, profit-producing equipment of our industrial establishments.

This history of substitution that I referred to a moment ago has gone a great deal farther than we ordinarily realize. A short time ago, I was visiting a friend of mine who had built a new garage in the back of his house, and knowing that I was interested in lighting, he asked me to step out into the garage and see the lighting that he had installed—he was quite proud of it.

I went out there, and he said, "You know, I like to have lots of light when I work around a machine. I am a great believer in plenty of light. I got this big fellow and I had it installed right up here in the center." What he had there was a bare, clear 200-watt Mazda C lamp in one central outlet at the top of the garage. He got plenty of light but not illumination. Then he showed me a very ingenious scheme that he was quite proud of, namely that when he wanted to work on his machine down under the hood he would take this big lamp out of its socket and screw in an extension cord, and carry this 200-watt lamp around with him, under the hood of his machine. Again, I guess we all agree that he had lots of light but very poor illumination.

LIGHT IMPROPERLY CONTROLLED CAN DO MORE HARM THAN GOOD

Light is capable of assuming two definite and distinctly opposite roles. Light can be a ministering angel or it can be an irritating fiend, depending upon whether or not it is controlled.

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It is interesting to recall that during the recent war on the western front, light was used in one case not to reveal or to disclose but to conceal. It was customary at times to throw up a light barrage between our lines and the lines of the enemy, so that what was going on behind our lines couldn't be seen from the other side. That was light in its negative role, the use of glare to interfere with vision rather than to aid vision. And yet this morning there are millions of those light barrages in our shops around the country deliberately erected between the workman and his machine.

The demand for more light is not new, but the appreciation of the distinction between light and illumination seems to be new to the average user of light.

One reason why we should have an interest in industrial lighting is a number of tests that were conducted in Chicago. These tests have been mentioned so often that I hesitate to mention them again, but during the war when everything was being done to speed up production, experiments were conducted to see what effect a new standard of illumination would have on production in these plants. The result was that a number of trial installations were made, ranging from ten to fifteen foot candles and upward, and it was found that in these plants, production was increased not one or two or three per cent, as we might at first expect, but increased ten, fifteen and twenty per cent, in some cases as high as thirty and thirty-five per cent. I know of one case where production was doubled simply due to a new order of illumination, lighting properly safeguarded as regards glare.

There have been a number of other tests conducted to confirm the tests made in Chicago. Most of those have not been completed, due to the fact that there has been a break in the continuity of operation in the plants where they were tried.

Ten years ago, Mr. Simpson, of the Travelers Insurance Company, gave us the report that out of a total of 91,000 accidents they had investigated in industrial plants, 23.8 per cent, or approximately one in four, were due in whole or in part to lighting, or to the misuse of lighting. That figure has been revised, and today instead of being 23 per cent, it is about 15 per cent of our industrial accidents which are traceable to faulty illumination.

There is a very general lack of knowledge as to what good industrial lighting is. For example, some time ago, I happened to be present at a demonstration where a modern lighting system was being shown to a number of men prominent in industry. As these men came up to look at that lighting, they would stand in the doorway of the particular room and look around. First there was a low, mediocre system of lighting turned on, and then a modern, properly designed system was turned on, and as the high intensity system came on, they said, "My, isn't that fine, that certainly is wonderful light!" That was the only analysis those men made of that lighting.

What we had to do in that particular case was to take those men almost literally by the lapels of their coats and take them into that shop, get them to work with drop cord lighting, and then with general illumination, call

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their attention to the effect of reflected glare in the eyes of the workmen or sharp shadows, and so on. Then they went away with a different idea of what good lighting is, because, after all, illumination is something that is down here where we work and earn our living and not something hanging up on the ceiling.

GLARE MAKES POOR ILLUMINATION AND CAUSES EYE FATIGUE

Put the question to the average man as to what he thinks of the light in a given room. He will look at the ceiling, and that is about the only place he will look before he will give his answer. I used to look at lighting in that casual way until I started to go out with some of the illuminating engineers to investigate lighting under different installations. I noticed when I went with one of these men into a plant, he would look at the general effect, but first thing I would know, he would be making a few passes over the table with his hands. If he was in an office, he might take a pencil out of his pocket and set it down and call attention to the four or six sharp black radiating shadows around that pencil point, things that have time and again annoyed us and made us condemn artificial lighting rather than the wrong class of artificial lighting which was in use. Then perhaps he would take his watch out of his pocket and study the effect of reflected glare, that thing which gives the diamond its beauty and brilliance but which when spread around a plant in wholesale measure is extremely harmful to the eye-sight.

For example, in this room with open reflectors, take the watch out of your pocket and see the image dancing around in the crystal of the watch. It is some of these common-sense, everyday factors in illumination that have been overlooked.

We want to think of good lighting not so much in terms of diagrams and charts, but in terms of human experience, because we are encountering reactions to lighting systems almost every minute of our lives. Light should be a servant rather than the master, and yet when we stop to analyze our reactions under lighting, we find that light bosses us around a good deal during the course of the day without our realizing it. We will move a bulky chair to get within the rays of a limited amount of light. Perhaps in the shop we will assume some awkward position unconsciously to dodge one of these reflected images. All of these things are things that are with us every day.

There is one all important phase of illumination that seems to have been overlooked for years. Efficiency engineers have been investigating motion study and have been doing everything to keep us up to the very highest notch of efficiency, and yet for years we have overlooked this one fundamental fact which has been developed during the past two or three years, namely, that there is a time element in the visual equation; in other words, that it takes time to see.

The eye is very much like a camera, or perhaps I should say a camera is very much like the eye, taking a series of photographs moment by moment throughout the day.

For example, up there is a sign that reads "Exit." In the time that I have looked at that sign, my eye has been taking a great number of pho-

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tographic impressions. If I were taking that photograph with a camera, the amount of exposure required would depend upon the light present, and if there was a glare present, I would have halation. The same thing is true of the eye, that is, the amount of light on that sign determines how quickly my eye registers that impression. These very small, infinitesimal particles of time at the end of the day spell eye fatigue, decreased output, increased spoilage and greater accident hazard, because, after all, from the standpoint of lighting, our working day is not made up of so many hours and minutes but rather of a great many very small fractional parts of a second which taken together spell these losses at the end of a day that I have just referred to.

There are also losses of time which are finite, due to improper lighting; the hunting of a misplaced tool in a dark shadow, the carrying of a micrometer over to the window or some other place where it is light to make measurements. So, we have both the finite and the infinitesimal losses of time due to inadequate or improperly used light.

I mentioned some of the statistics prepared by Mr. Simpson, of the Travelers Insurance Company, and rather than go on quoting statistics on the effect of lighting upon safety, I would commend to you a paper entitled "The High Cost of Poor Lighting," by Mr. Simpson before the Illuminating Engineering Society last year.

We have been spending just half an hour on this talk. During that half hour fifteen people have been injured throughout this country as a result of faulty illumination. They have been injured to the extent that they are going to lose two and a half weeks' time. Before we are through discussing this subject this morning, one person will have been killed as a result of faulty illumination.

Mr. Simpson points out that simply placing a dollars and cents value on the time lost as a result of accidents, there is a loss to industry in this country every year of $300,000,000. The total industrial output of this country is valued at something like $25,000,000,000. If we grant that lighting can reduce spoilage or increase production even a modest 3 per cent, which will mean $700,000,000, and if we add that to the $300,000,000 loss due to time lost, we find that it is a very conservative estimate to say that this country is losing every year $1,000,000,000 due to faulty illumination in our industrial plants. We have a habit of swallowing all statistics rather glibly, because we are used to talking in terms of millions and billions. But now let us just recall how deep down in each and every one of our pockets it went when our nation had to raise a $2,000,000,000 loan. Every one of us was affected, with this marked distinction: in that case we were making an investment, and in this case we are paying a tax as a result of poor illumination.

THE ECONOMIC VALUE OF GOOD INDUSTRIAL LIGHTING

Bringing this down to terms of the individual plant, especially at the present time, we hear a great deal of talk that runs something like this: "Yes, this is a very good thought, this better industrial lighting, but plants are being closed down, employees are laid off, and plants are in

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no position to make the investment at this time." And yet ten dollars per workman will install modern illumination.

Take the extreme case of a plant that is entirely shut down, when it begins to hire back men, if they will set ten dollars aside for each man taken back, they can start out on a new and modern basis of illumination, and according to such statistics as we have, that ten dollars will be returned to them within the first month of operation.

The cost of lighting is so small that for that reason perhaps we have placed it in the general service class, but, in view of the different messages that have come to us with regard to the importance of lighting, it is time that we began to think of illumination on a higher plane than we have in the past, give it more serious consideration, and consider it as part of the profit-producing, labor-saving and life-saving equipment of our industrial establishments.

PRESIDENT TOLMAN: Mr. Shenton and Mr. Turner are twins, although the names wouldn't indicate that, nor their facial style of beauty. Mr. Shenton has given us the "why" of industrial lighting. Mr. Turner is to tell us "how."

BETTER INDUSTRIAL LIGHTING—HOW?

A. S. TURNER, EDISON LAMP WORKS, HARRISON, N. J.

Mr. Shenton has very ably told you why we are interested as industrial men in better illumination. He mentioned the factors which come into lighting—intensity, diffusion, and glare. These are the three things which you as industrial people should look out for in your plants.

If you have good illumination, you will have a sufficient intensity to carry the work on in the shortest time and in the best way possible. If you have good illumination, you will have a diffusion of light—by diffusion I mean the lack of dense and black shadows—rather than the objectionable dark and heavy shadows. If you have good illumination, you will have none of this bugbear which we are all interested in, that is glare. Glare has been defined as the comparison of the light source to its background. We have no instrument, we have no means of measuring this harmful effect upon the eye, and we wish we did; but every man has a note in his own eye which will tell when there is glare present. If you look up at any one of these units in this room and shut your eyes, you will all see that filament reflected in your eye after you have looked at it. That is glare—the harmful effect upon the eye. You get the same thing by reflection back from a surface beneath rather than from the light source above. That glare is harder on the eye than direct glare, for the simple reason that we have no eye-lashes below to protect that light from hitting our eyes, as we have from above.

In order to get good illumination, there are certain things which we must have; that is, correct size of lamp, correct type, and proper reflecting equipment. Today, the modern lamp is divided into two classes, the Mazda B, or vacuum type lamp, which may be always known in its common sizes by its straight-side bulb; and the Mazda C, or gas-filled lamp, which

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is made in the higher wattages, which in its common sizes is in the shape of a pear. But if we were just to use lamps, we would lose a great deal in the efficiency of our system, and in order to overcome that we use what we know as a reflector.

The purpose of a reflector is, first of all, to reflect the light coming from the bright, concentrated light source; second, to diffuse or modify that light; third, to shield the eyes from that bright filament; and in industrial work sometimes we may say that the reflector is acting as a guard for the lamp to prevent breakage.

We have several general classes of reflectors known as the direct, the enclosing type, the semi-indirect and the totally indirect. For common practice, we will say that the direct lighting fixture is that which directs the majority of its light directly down upon the work. An enclosing unit may diffuse the light in all directions. A semi-indirect unit will throw the maximum light away from the work or toward the ceiling and throw some of the light back through the transparent bowl; while totally indirect will throw all of the light to the ceiling, allowing none to come through the bowl.

TYPES OF LIGHTING BEST SUITED TO INDUSTRIAL PLANTS

For industrial work, the direct type of lighting is probably the most applicable, because efficiency decreases in the order of the different systems which I have mentioned.

The standard dome reflector is a direct lighting unit which we find today to fill the requirements in 90 per cent of the industrial plants. That reflector was designed, as its name implies, by the manufacturers of reflectors and lamps, and engineers, when the Mazda C lamp was first brought on the market. This reflector is now being manufactured by practically every reflector manufacturer, and it is being backed by the standard of the Electrical Testing Laboratories, so that when you buy a reflector which is marked R. L. M. you know you are getting a standard product. It is not any particular manufacturer's product; it is a product which has been designed primarily to give you the best that there is for industrial lighting.

Then again there are some places where you need a little light on the ceiling. This is particularly true where you have women employed. Men it doesn't seem to affect so much, but women like to have the entire room lighted up, as well as the work. This may be accomplished either by using a glass top on the steel reflector that throws some light up, or by using an entire glass reflector.

There is one lamp, a most recent development, which we call the bowl enamel lamp. On the bowl of this lamp, we have placed a white coating of enamel. The purpose of that is to act as a small semi-indirect dish which reflects the light back into the reflector and then down, some of the light coming through, but the brightness of the bowl is reduced so that the entire reflector and lamp appear practically the same brightness. Such a lamp produces a diffusion of light rather than a glaring and harsh shadow lighting system.

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Certain terms in lighting may not be quite clear to you. The foot candle is our unit of intensity of illumination, the unit amount of light you have on any surface, just like a degree of temperature. This unit is not as complicated as it might seem. A foot candle is the amount of light which is on the surface one foot away from a one candle power source. It is nothing but our unit of measurement.

We have different systems of lighting. Local lighting consisted of an individual lamp for every workman, for every machine, and for every space of working area. But as we got to the larger size of lamps, we found that local lighting was very objectionable, first of all, due to glare, and then reflected glare, and also due to the contrast of intensity. If you use local lighting and have no other light in the building, you will find you have a small bright area, and adjacent to that a dark area. That means that every time you look from this light to the dark area, your eye has to adjust itself to the different intensity. That means a loss of time due to that change in the adjustment of the eye.

The next system is what we call localized general. That is, we space the unit with respect to the machine, but we get them up out of the way of the workmen, so that the man does not have a shadow every time he puts his hand in front of the local light, placing them up so that a man gets light from more than one unit. In that way there is an overlap, so that the shadows are minimized.

Then we go to the strictly general illumination where all of the light comes from above. General illumination is finding more and more popularity every day, because we find that with it we are approaching that which we are really striving for—an approximation of daylight. By having our light sources fairly close together, we can overlap the light and produce an intensity throughout the entire room, and thus do away with this fault of having to readjust our eyes every time we look from one portion of the room to the other.

HOW TO DETERMINE EFFICIENCY OF LIGHTING SYSTEM

You say, "How do we as illuminating engineers go about calculating a system?" It is not as hard as you might think, and a lot of people have thought that illuminating engineering was too far above them to even consider it. I think possibly I can give you a little short method whereby you can lay out or at least check up on what you have.

First of all, we find out what the efficiency of a reflector is, that is, of the amount of light generated by the lamp we find out what proportion really comes out of the reflector. With the R. L. M. lamp, we get an efficiency of somewhere around 73 per cent; with a deep bowl we get an efficiency of about 70 per cent; whereas with an enclosed glass unit, we would have part of our lighting going to our ceiling, we would have an over all efficiency of somewhere around 80 per cent. But every room is not alike in color, nor are objects in the room, and so on, and we have to take into account something as to the surroundings. So we have taken typical rooms and put in units, and we find out what percentage of the light that is coming out of the reflector is going to be actually useful on the work.

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Then by combining those two efficiencies we get what we call our coefficient of utilization for any particular class of unit in a certain general type of room. If we have a unit of 70 per cent efficiency, such as the R. L. M., and if we find that in a modern shop, where the walls and ceiling are light, we get about 70 per cent of that efficiency on the work, we can say that out of the light given off by the lamp we are going to have 70 per cent times 70 per cent or 49 per cent, or, for rough figures, 50 per cent of that light effective on the work, where the man is going to be actually working. So that if we are figuring in an industrial plant where there are light walls and ceilings, we find with the R. L. M., the bowl enamel lamp, an efficiency of approximately 50 per cent.

Now let us take a room, for example, 30 by 30 feet, with a 12-foot ceiling. We know by experience that to get even illumination with this direct lighting equipment, we should not place the units farther apart than they are hung high. If we have a 12-foot ceiling, we can't hang them over 11 feet high. That gives us 11-foot hanging height and 11-foot spacing, we will say, but on account of being 30 feet that isn't even, and we will have to take 10 feet which is the nearest even division. So we will have each lamp covering an area of 10 by 10 or 100 square feet. We will now say for this class of work we have found that the best lighting is obtained by 10 foot-candle illumination. The tables on that would be obtained from any of the reflector lamp people, or anybody interested in illumination, showing the desirable amount of light on a particular class of work.

WHAT A FOOT CANDLE IS

A foot candle is the amount of light given off by a lumen on a square foot, so 10-foot candles would be ten times that, or ten lumens. We have 100 square feet, so that would give us 1,000 lumens necessary on our work. But I just said we only had a 50 per cent efficient system. Therefore, we need to generate 2,000 lumens from our lamps. Our lamps are rated in watts and lumens when they are sent out to you. We find that a 150-watt lamp gives off 2,100 lumens, which is as close as we can come to the 2,000. We have our system now all designed. We have 150-watt lamp, bowl enamel, the R. L. M. dome reflectors, on 10-foot centers hung 11 feet high, and that is the solution of our problem.

Now, we may take a typical craneway construction. There is a general suggestion—use angle reflectors because of the width, one overhead to take care of some light under the crane, and on the side use general illumination evenly placed throughout the length.

I would like to warn you not to use angle reflectors lower than eighteen feet. If you do, you will find very objectionable glare to the workmen who have to look directly down the building or across the building and look right into those units. That is very bad indeed. It is better to have all your system from above the crane. In case of a dangerous shadow in that case, hang a couple of units on the bottom of the crane; it will always take its light along with it where it is wanted and you will eliminate the danger of black shadows from the unit above.

Let us just compare for a minute the difference between what we are

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now using or recommending for artificial lighting, and what we actually have in daylight.

Out on a field or a golf course, we find that the intensity of light from the sun will be 8,000 foot-candles, and we are talking in terms of ten and twenty. Every one of you has probably spent some time reading a book out under the shade of a tree, and you had no difficulty, no eye strain—in fact, it was very enjoyable. When you did that, you had 500 foot-candles, and still we are talking in terms of ten.

Out on the street, in the sun, we have 3,000; in the shade 300. Even in our modern office buildings in the daytime we have an intensity ranging from 50 to 100 foot-candles or thereabouts, according to the position of the desk. And yet there were certain men who made the statement about a year ago that New York City's office buildings were over-lighted. When we heard that, we made some tests, and we found out that they had an average intensity in most of the buildings of around 3 foot-candles at night. We found that they were not over-lighted, but that they were over-glared; that was the trouble. The public does not understand the difference, and it is the people who go out and meet the public that have to tell them and show them why it is that they are getting glare and not illumination.

There is one thing I want to impress on you, and that is that it would pay every plant to revise its system. If we can cut down the accidents 10 per cent, or, on the other hand, if we can increase the production of a man so that he saves three minutes of his time a day, we can pay for this illumination change.

PRESIDENT TOLMAN: We have next a paper by Mr. W. E. Worth.

THE NEED FOR ACCIDENT PREVENTION WORK AND METHODS TO BE EMPLOYED DURING THE PRESENT INDUSTRIAL DEPRESSION

W. E. WORTH, ASSISTANT MANAGER OF INDUSTRIAL RELATIONS, INTERNATIONAL HARVESTER COMPANY, CHICAGO, AND THIRD VICE-PRESIDENT, NATIONAL SAFETY COUNCIL

For my inspiration, I am going to take the proverb, "The wise man seeth the evil day afar off and prepareth himself accordingly." I have translated it into modern parlance to read "The prudent man sees accident hazards afar off and protects his plant accordingly, but the foolish man sees no danger until it is too late."

In other words—wise is that concern which sees days of high production ahead and prepares for maximum efficiency in the crusade against industrial accident hazards which inevitably multiply with increased production.

The progressive company is today getting ready for business. When the present depression will end is problematical, but it goes without saying that few if any concerns are closing up business discouraged because of

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the reaction which seemed imminent even in the most palmy days of the past few years. What, then, should the average institution be doing right now? In most cases executives are getting their organizations and plants in shape for production. The experience of the past is being used in anticipating the problems of the future. Methods which are costly and not over-efficient are being discarded for better systems, and a "house cleaning" is under way.

Many companies are carrying on long delayed construction and are overhauling their producing mechanism—work which heretofore has been postponed due to the pressure of other things. Wages and prices are being altered to meet changing conditions. Business is in the transitional adjustment period between abnormal production and normal production.

I would like to ask any executive of any fair sized company these questions:

"Were your accident costs in 1919 and 1920 higher than any previous two year period?"

And then—

"What do you think the same costs would have amounted to if there had been no safety work done in your organization?"

And lastly—

"Can you afford to neglect, even for a short period, the industrial accident phase of your business which because of legal enactments and other causes represents potential liabilities and a distinct responsibility without end?"

REASONS FOR CONTINUANCE OF SAFETY WORK DURING DEPRESSION

I don't need to call your attention to the fact that in the past few years compensation for accidents has been getting more and more expensive, and I have pretty well fixed in my own mind that as we fail to eliminate the hazards, make better working conditions and generally improve the situation in our plants, the hazard of increased cost of compensation is great.

The industrial atmosphere of a year hence will be one of utmost efficiency mechanically and financially, and unlucky will be that concern which neglects to plug up the leaks which constantly threaten to fill up the debit side of the ledger.

Accident prevention work is necessary at all times. The value of such work cannot be estimated precisely in dollars and cents, but it can be somewhat computed by comparing the accident frequency and severity in any one industry before any safety work is done with the frequency and severity under an organized active safety program.

If compensation had been paid ten years ago for industrial accidents at the rate now required by law in most states and countries, industry would undoubtedly by this time have worked out fool-proof and accident-proof methods that would outshine by far what we have already accomplished in the safety movement.

Safety work should not be discontinued for the sake of economy during the period of industrial depression. The top-heavy, the unprofitable, the

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inefficient safety department where and if it does exist, should, of course, be cut like any other department.

Good business methods dictate retrenchment and economy today, but the really efficient plant manager does not undertake retrenchment without intelligent and careful investigation. The industrial manager whose policy has been guided by intelligent and careful investigation has not abolished or even temporarily suspended his safety department. He is retaining the skeleton of the department for its regular work, and placing the other members of the department out in the plant and at the bench, the machine, the assembly table.

No plant whose accident problems in normal times are serious enough to require a safety department or even a part-time safety man can afford now to sacrifice that investment. It has been an investment. You have taken the time of yourself, as manager, the time of the superintendent, the time of your men, the salary of the men instrumental in building up your safety department; and it is an investment.

No employer who has been trying to convince his employees that he is sincere when he tries to reduce accidents in his plant can longer keep the confidence of his employees when he abolishes all effort with the reduction of the working force. The employer must realize that the elimination of lost-time accidents is the result only of a long, positive campaign, and his employees will be convinced of this only by seeing the campaign carried on through slack production times. To stand still is to go back. Vigilance only will bring results, and it is essential to the employer and employee alike that the safety man should be ever on guard to eradicate hazard.

ACCIDENTS IN TIMES OF DEPRESSION ARE MORE EXPENSIVE THAN IN NORMAL TIMES

The plant managers must remember that an accident is now a much more expensive proposition than the same accident when the plant was running full blast. If only ten men are working in your plant and one is killed or injured, the proportion of the cost of that accident to your manufacturing cost is much greater than it would be if the man were the victim of an accident with a hundred men on the job. In these days when many men, who in times of peak production are specialists, do five or six kinds of work, the possibility of accident is far greater than in normal times. It is necessary today to train the old employee on a new job as it was formerly to supervise the new employee. While this duty primarily lies with the foreman, the management must indicate to the foreman no loss of faith in the safety work by discontinuing the active evidence of this faith.

While the majority of us probably agree on the efficacy, place and time for safety work, a discussion of what to do to get the highest return for the amount of time and labor and money expended during present conditions is now most timely.

I know of at least four large organizations with plants in various parts of the country which have maintained the skeleton of their safety or-

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ganization throughout the depressed period with most sanguine results today.

What these concerns are doing is this—a rigid inspection is given all the mechanical property used in the producing operation. This is being done gradually in person by the men responsible for the safety work of each plant. Their job is to go over the plant, machine by machine, inspect it, test it, looking for all possible hazards. Actual methods and suggestions for obliterating the risks observed in the inspection are properly noted. The progress of this work is observed closely by the executive under whose direction the work is carried on, and no actual changes are made until careful investigation has pointed out the most practical way of meeting the problems brought to light by the plant inspection. The fine tooth comb system is bringing results and is being adapted to other phases of slack period production. The "penny wise and pound foolish" statement cannot in any sense be applied to these companies.

In our company, the group of plant safety inspectors meets each month and discusses the safety problems of today and the future. Plans are laid, views and experiences exchanged, and practical knowledge of a very valuable sort disseminated. Specific subjects of safety work are assigned in each meeting, and minutes are kept of all that is said and done. These minutes are circulated throughout the entire manufacturing organization, including superintendents, works managers, vice-presidents, and to the safety inspectors themselves.

A standardization of several important safeguards has already come out of these discussions. I recently asked a group of our plant safety men what they considered the most important feature of the safety work of today. Their answers varied somewhat, but all of them referred to the effect of the continuity of safety work on the workers left in the various plants. As one man said, "When work becomes slack and times bad, the workman and even the foreman who doubts the value of the safety work notes with pleasure the falling interest of the management in safety and says to his co-workers, 'Didn't I tell you so; it is just a game to save their own money,' and then we're back where we started again."

FOR SAFETY'S SAKE MEN MUST BE KEPT FROM WORRYING ABOUT SECURITY OF THEIR JOBS

One of the safety man's big jobs right now, so far as the workmen are concerned, is to keep them from worrying about losing their jobs. A man that is worrying about the conditions at home is not a safe man, not as safe as the man who is not worrying about the conditions at home. Any employee who is worrying about his job is much more likely to stick his finger in the wrong place than is the one who is not.

The changing of jobs on the part of the workmen kept in the plant requires strict attention on the part of the safety man. In many cases, under present industrial conditions, the safety man works along with the others, at the bench and at the machine. His job under such conditions is to take every opportunity to instruct the others in the safe way of doing things.

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I know of one case which happened in one of our plants where a safety man went to work in the shop. His every movement was more or less marked, and he was, because of this conscious espionage, called upon to keep his wits about him and use the proper tools and use the proper safeguards at every turn. Needless to say, he has accomplished wonders by this experience, not only with the men but with the management as well.

In the case of this man that I refer to—he was a very hard worker and he hadn't been getting results that we would have liked to have seen, but the moment he went into the shop, working at the bench, every foreman, every superintendent, every man going by the place where he was working had him under surveillance and was very carefully watching him to see if he made a move that wasn't absolutely safe. That man got a fine reaction out of that group of men, and when the plant started up here a few weeks ago, with a small number of men, he had been able, through the interest of these men and the interest of the superintendents, to have brought the safeguarding of that plant up to a standard which never had existed in that plant before. And incidentally, he has the absolute backing of all his foremen and the superintendent, as the result of that experience.

TIMES OF DEPRESSION PRESENT OPPORTUNITY TO MAKE PLANT SAFE FOR FUTURE BUSINESS BOOM

Now what happens when, in times like the present, the safety man goes to work out in the plant? Unless he is a cynic, he begins to realize as he never did before the workman's point of view; he begins personally to experience the problems of the workman; at the same time that he is delivering a day's work to the production department, he is making himself a better safety man. When business picks up and the company is again anxious to get out a maximum production with a minimum of lost time and money, he is ready to step back into the safety department and do better safety work than ever before.

Now is the time for the management, by personal visit or correspondence, to 'look into this matter of safety,' to find out exactly what other plants have accomplished, and once and for all decide whether or not it is a good investment. I am sure that the headquarters of the National Safety Council will be glad to give any safety man or any industrial executive the names of half a dozen or more companies in his own industry that have given safety work a good tryout. Now is the time to visit other plants with accident problems such as your own, and to find out what they are doing to prevent those accidents—and take your manager with you on these visits.

The present so-called slack period presents another advantageous opportunity to the safety man and the plant executive who believes in accident prevention—the opportunity to make all the physical improvements for accident prevention that they have long wanted to make, but found impossible because it would have meant shutting down part of the plant. Now is the time to make the plant ship shape, so far as accident

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prevention is concerned; to overhaul and repair machinery; to revise manufacturing processes with a view to safety.

Here is another opportunity of the day. During recent years industrial relations men and safety men have justly lamented the disappearance of the personal contact between management and men. What better opportunity than now could there be to re-establish that personal touch with the old timers who remain at work?

Yesterday afternoon, if you were here, you were probably very much interested in the discussion by Mr. Forster of the engineering factor. I want to tell you what we did in connection with this engineering factor. I had been receiving on my desk, as a great many of us have, the Safe Practices pamphlets for revision before printing. I don't know what gave me the thought, or whether it was an inspiration, but the last two I have sent to our engineering departments in plants where such problems as are covered in these pamphlets are existing. One of them went to the chief of the work in our general office. He called a staff meeting of all the engineers affected in the Chicago plant, and he spent two days revising that rough form of the pamphlet.

Now, what has happened? We ought to have discovered long ago that by getting our engineers working, by giving them some constructive work, as they see it, which is technical work from the viewpoint of a technical man, we have tied in with our inspectors, in our Chicago plant, all the engineers that have to do with these problems. Another one has come on my desk within the last ten days. That is going to go to every plant, to twenty-six, and I am going to have that reviewed and get their viewpoint.

Mr. Oartel gave us illustration after illustration yesterday of how we improve efficiency by the co-operation of the two groups. One of the jobs that you might well set your mind to doing is an analysis of the causes of accidents. They were demonstrated yesterday, twenty-three causes. I don't know whether they are right or wrong, but right or wrong, if we will just analyze them on that basis or any other basis, and determine the root causes, as Mr. Forster expressed it, we could, when business picks up, attack the whole problem from a different viewpoint than we have heretofore. If past accidents are analyzed, surely we have a basis for preventing those of the future.

So much for the problems of today. They are important. But the safety problems of tomorrow are even more important. What I mean is this: the industrial manager who sets out to solve his immediate problems of economy, readjustment, retrenchment, etc., without regard to the need for an effective accident prevention organization that will come again the minute that business picks up, or without regard to the safety movement as a whole—such a man, I say, is penny wise and pound foolish. He loses sight of the fact that all of us must draw our labor supply from the same reservoir and that if every employer were to follow him we would soon find ourselves where we were ten years ago in accident prevention work—trying to convince the workmen that we are sincere when we say to him, "We are doing everything in our power to prevent accidents in this plant and we expect you to do as much."

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Such a man is overlooking the fact that organized accident prevention work is no fad, fancy, or experiment; he is losing sight of the fact that the managers of more than eight thousand industrial properties—small plants as well as the biggest corporations of the country—have been convinced of the soundness of such work. Above all, such a man overlooks the fact that the whole safety movement was built up entirely through co-operation, and is today co-operative and non-commercial in the best sense of the word. The National Safety Council has no stockholders, bondholders, or profits of any kind. It is able to render the service that it does solely because the co-operation of its members enables it to put every dollar of membership dues back into the service to members.

The industrial manager who discontinues or suspends his safety work must realize that his failure to "carry on" is not only poor business, so far as his own property is concerned, but a detriment to the movement as a whole and to the thousands of other employers who have faith in it.

DISCUSSION

PRESIDENT TOLMAN: I want to say that the urge to constant safety activities through this period of business depression is being recognized by executives, as illustrated by the fact that our membership is ninety per cent of the membership prior to the business depression. Each member represents an executive who believes in the continuity of safety activities through the period of business depression. The State of Massachusetts has subscribed to that principle, and it is my pleasure to introduce General E. L. Sweetser, Commissioner of Labor and Industries, State of Massachusetts.

GENERAL SWEETSER: I can't see any difference between times of industrial depression and times when we are working overtime as far as industrial safety is concerned. There is just as much need of it one time as there is at the other. Now is the time to do a little preliminary work, look over the plant and instruct those key men that you have retained when you have let the others go, in all the points in industrial safety, so that when the rush comes you won't have to devote the time then, you have done the training. In the time of peace, you have prepared for war.

In our department, we have tried to locate the sore spots that needed immediate treatment. If you find the men that run those industries and show them what the tabulation is and that they have more accidents, according to the percentage of number of hours and number of men employed than they should have, you will find that you are met more than half way.

Only recently I had a meeting of the heads in a big industry in Massachusetts, and I told them that their percentage of accidents was too great. They didn't believe it at first. I was talking to these men on the ground of the cost of their accidents and what it would save to prevent them. One of them finally said, "General, don't give us any more of that talk, we don't care what it costs. We will go at it and do the best we can to

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prevent these industrial accidents in our factory." It was the human side, after all, that made the appeal.

It seems to me that every organization and every factory and every plant ought to have a safety committee. Even if it is only a small plant, the boss himself can be a pretty good all-round safety committee if he enters into it with the right spirit. But the mere fact that you have a safety committee is not enough. It must be a real safety committee, one that is on to its job and one that knows how to make an inspection, one that is backed up by the head of the plant and one that isn't afraid to make recommendations and insist upon them.

Above all, it seems to me you must tabulate your results. You must analyze the accidents you have, find out the cause, the reason why they occur, and who is responsible, and when you arrive at that, you have something to work on to prevent the next accident.

SAFETY RULES MUST BE OBSERVED BY THE BOSS IF MEN ARE EXPECTED TO OBEY THEM

Sometimes in visiting plants I see in the different divisions of buildings a bulletin board which says, "This week the number of accidents was three or four." I go to the next and they have a clean slate. That keeps up the enthusiasm, though sometimes I have suspected that it keeps some of the employees in that department from reporting a minor accident. As the result of our recent investigation in this state, we are taking up now the number of infected accidents. The percentage is too large. I went into a plant only last week, a very fine plant, perhaps one of the best in the state. In going the rounds, we started at the top floor. The employer always likes to walk down rather than up. He said, "We will take the elevator." We went to the rear of the plant, and, of course, I knew what was coming—we were going to take the freight elevator. I saw the usual sign on the freight elevator, "No passengers admitted." In going up slowly, I asked the elevator man if he frequently took passengers up. He said, "No one is allowed on this elevator." I said, "What is the matter with me?" There was an order that no one was allowed to ride on that elevator except the operator, but if he let me on and the boss on, and the employees saw us riding up, why shouldn't they ride, too? Of course, you can't have military discipline in a plant, but if you are going to issue an order, it is the duty of the foreman or the superintendent to see that it is obeyed.

If you issue orders and some man in your plant gets injured, why shouldn't the foreman be held responsible? Has the foreman given him proper instructions not only how to run that machine and get the most production out of it, but how to avoid the danger in that machine? Has he told him anything about safety, and the necessity of playing safe not only for his own benefit but for the benefit of his fellow-employees? Or has he let him go and said, "He has the information, he will take care of himself, or ought to take care of himself?"

PRESIDENT TOLMAN: I am sure we appreciate what the commissioner

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has had to say to us. I want to put one thought in his mind which is perhaps familiar to many, that five per cent of the workers in industry are killed in public accidents, so that although his title reads Commissioner of Labor and Industry, I think that by a stretch, and a very slight one, of the imagination, some of his efficient work may be applied to the public safety activities of the state.

Mr. R. C. Folsom, of the American Sugar Refining Company, has been asked to follow General Sweetser in the discussion of this problem.

MR. FOLSOM: I have been asked to give a brief outline of the reasons why we maintained our safety department in this time of depression. It is unnecessary to state that, like every manufacturing organization in the land, we have been eliminating the non-essentials and putting every branch of our organization to the acid test.

The logical method of consideration is first to analyze why we desired to continue the work of the department; second, to show why we felt obliged to do so, giving concrete results as justification; third, to show why it was decided to continue delegating the work to an organized safety department instead of dividing it among other members of the staff. The first question is easily answered.

Safety work is primarily a humanitarian proposition carried on for altruistic purposes. The same impulse that prompts us to lead a blind or feeble person across a crowded thoroughfare or induces us to remove a banana peel from the sidewalk underlies all safety work, and in the final analysis it is a practical application of the golden rule.

Man is a gregarious animal and as he advanced in enlightenment he began to recognize the fact more and more fully that whatever resulted in the betterment of his fellow being was reflected in his own condition and well-being. Hence society took and carried on through organized government the care of the needy, the feeble and the sick, and the protection of its members against the ravages of nature, as well as against the aggressions of man. Among the latest of these developments may be listed safety work, and, closely allied with it, welfare work.

To the manufacturer and business man safety work in its broadest aspect is no longer merely a question whether this or that is required by the state law or local ordinance, or whether the rate reduction for a certain improved condition outweighs the cost, it is rather, what can I do to thoroughly protect the man on the job against accident, to keep him in best physical condition with the body active and the mind alert. These all tend toward greater production, better work, less time-loss and less turn-over, and above all a greater interest by the employee in the work in hand, and a far greater loyalty to the employer.

The above considerations show the desirability of continuing the good work, but how about the necessity?

REASONS WHY CONTINUANCE OF SAFETY WORK DURING DEPRESSION IS NOT ONLY DESIRABLE BUT NECESSARY

An actual survey of the results obtained by the safety engineer and his department showed that the frequency rate had increased, due to

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reporting all minor accidents of types never before recorded. The severity rate however, had decreased about 15 per cent. This, the only measurable quantity within our reach, seemed to indicate that the work of the safety department was actually bringing about the results predicted in our theoretical consideration.

Is it necessary and worth while to continue getting these results or can they be postponed in view of present conditions? It is not a question of abolition—we have already indicated the desirability of this work—but of temporary suspension.

Since the predicted results of safety work are interest, loyalty, less time loss and less turnover, it is even more important that these should be obtained during periods of industrial depression than in times of industrial activity. In the latter case when profits are relatively larger, losses are more readily absorbed and even lapses of efficiency do not affect the balances as is the case when the closest supervision must be practiced in the conduct of the business. It is during the periods of depression when the greatest individual efforts, the closest attention to the business at hand and the interest and loyalty of the employee count most.

During the period through which we are now passing, forces have had necessarily to be reduced, in some instances to mere skeletons of future organizations. These backbones of future forces constitute, as a rule, the best material that could be chosen, men and women who have demonstrated their diligence, capability, and interest in the work and loyalty to their employers. Hence, not only is there a reciprocal obligation involved in maintaining all that safety work implies, but everything that can be done to keep this nucleus intact and keyed up to the highest point of efficiency is essential. Letting down the bars in safety and welfare work will do much to impair this efficiency and handicap future organization. It may reasonably be argued that an employee, realizing the financial loss of an enforced layoff due to injuries, a loss more serious in this time of depression, slack work, and short time, will be more careful. Our records, however, do not support this contention. There are undoubtedly some employees who are more careful, but they are far outnumbered by those who, in fear of further reductions in the number of employees, try to prove themselves more willing and more effective than their fellow workers, and hence take unwarranted risks.

Another important consideration is the state of mind of the employees in time of depression. Curtailment of production and reduction of labor produce mental depression, making the employee more susceptible to accidents. The effect of lost time accidents upon production is magnified under present conditions. Reduction in volume of business, cessation of improvement work and reduction in repairs to those absolutely necessary, cause the normal working forces to be reduced to a minimum. Under these conditions a few absences from any given department, absences which under normal conditions would not have an appreciable effect, might seriously interfere with operations and consequent production.

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We should not entirely forget the future to meet today's necessities. The effect of suspending the safety department would not be confined alone to the period of depression during which it was suspended. Without a constant reminder, the employees would lapse into their old thoughtlessness, and all the work done along educational lines would be lost. Doing this work over again would take longer, as its news value would be stale and the response slower. These were our reasons for deciding that the work of the safety department must be kept up. How?

TO BE SUCCESSFUL SAFETY WORK MUST RECEIVE EXCLUSIVE ATTENTION OF EXPERIENCED MAN

The work divides itself naturally into two divisions—the prevention of hazards, and the education of employees. The prevention of hazards might be cared for without any safety department as part of the routine duties of the engineering department. Less than 5 per cent of our accidents are preventable by safety work, however, so that education of the employee is the prime consideration. There must be a constant propaganda of "safety first" or the employee ceases to think of safety and becomes careless. Can this educational work be done without a safety department? Who can do it? Each department has been so reduced that everyone's time is fully occupied with direct duties and no one has any time for "such side-lines as Safety". If this work is delegated to one or more department heads it becomes a secondary duty and receives secondary consideration.

There is a danger of not doing enough educational work, and there is danger of overdoing it. It requires experience and tact to repeat a message constantly without diminishing its effectiveness. To assure this work being done efficiently it must be made the primary and sole duty of an experienced man.

In conclusion—we decided first that safety work was desirable, second that it paid, and third that it required the exclusive attention of an experienced specialist. We therefore maintained our safety department.

ADJOURNMENT.

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General Session: Health and Sanitation

Joint Meeting of the Health Service Section, the American Association of Industrial Physicians and Surgeons, and the Women in Industry Section

September 29, 1921

DR. A. W. COLCORD, Presiding
Carnegie Steel Company, Clairton, Pa.

CHAIRMAN COLCORD: The first paper by Dr. Reynold A. Spaeth, of Johns Hopkins, is to be read by Dr. W. A. Sawyer because of Dr. Spaeth's absence.

THE WORK-DAY AND INDUSTRIAL HEALTH

DR. REYNOLD A. SPAETH, ASSOCIATE IN PHYSIOLOGY, SCHOOL OF HYGIENE AND PUBLIC HEALTH, JOHNS HOPKINS UNIVERSITY, BALTIMORE

Science has been called the modern man's religion. When he finds himself entangled in a particularly complicated problem, instead of consulting Aristotle or the Scriptures, he appoints a committee to gather statistics. This expedient is frequently successful. There is something formidable about an array of figures. Graphs and charts give a dazzling impression of irevocability and expert knowledge, especially when backed by a dozen integration symbols. Whether the particular problem can really be solved by the machinery of science is rarely asked.

The question of the length of the industrial work-day is a striking illustration of the merciless application of scientific method.

Apparently convincing figures have been gathered to prove the greater efficiency of the twelve, ten, eight or even six hour day in various industries. The key to a better understanding of the situation seems to lie in that word "efficiency". The moment we apply the efficiency criterion we may ask "But efficient from what view-point?" If you chance to be an operator or a production manager or a stockholder you naturally concentrate on output and profits. Or again you may be an active trade unionist or a member of some co-operative society, in which case your primary interest lies in high wages and an attractively low sale price

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to the consumer. In other words "efficiency" is purely a scientific problem when applied to the behavior (i. e., power consumption, etc.) of inanimate machines, but the moment it involves the health and happiness of human beings a moral factor is introduced and the problem passes from a purely scientific to a social-ethical level where science cannot and dare not follow. The failure to distinguish clearly between these two levels—the unmoral and dispassionate scientific one and the social-ethical level, has led to a vast amount of controversy and misunderstanding. An illustration will clarify the point.

HOPELESS THING TO PROVE ACTUAL INJURY RESULTING FROM LONGER WORKING HOURS

Last year the Women's Joint Legislative Conference asked a certain association of merchants to endorse an eight hour bill. The committee of the merchants' association insisted that the only basis for endorsement by them would be the proof that the health of women was disastrously affected by nine hours of work and would be protected by eight hours and that production would be as great and as cheap in eight hours as in nine. Those of you who have had experience with physical examinations will appreciate that exact evidence of actual injury resulting from one extra hour of work per day is a hopeless thing to prove. We have troubles enough trying to run down that elusive and academic individual, the "normal" man or woman. Human variation is far greater than the merchants' committee realized. The work-day problem to them was purely a question of cost of production. The illustration is of interest chiefly in showing how completely we may miss the real issue and yet how safe and reasonable we feel, by blinding our eyes with the glamour of scientific method.

Another example of the confusion that arises from concentrating on the statistical aspects of the problem is afforded by the recent publication of The United States Public Health Service Bulletin No. 106. In this case a study was made of the relative efficiency of an eight and a ten hour plant. The verdict was in favor of the eight hour system. Efficiency, as usual, was undefined.

This bulletin has called forth a storm of criticism. In a special report (No. 14) the National Industrial Conference Board believes to have demonstrated without question that "the conclusions (of Bulletin 106) are essentially unscientific and not justified by the data offered" since the two plants are not fairly comparable; and the basis of experience is too small to justify comprehensive conclusions applicable to industry in general.

In reviewing the Public Health Service Bulletin in the *Journal of Industrial Hygiene* Dr. Drinker asks:

"(1) Can a comparison of two factories under different managements" (and at different wage levels, we may add) "give any valid information as to the proper length of the work-day?

"(2) Is it sound procedure to neglect practically entirely the medical and sociological aspects of a problem so important and so pretentiously undertaken as the one in hand?

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"The presentation strikes one more as a well organized argument for eight hours of work than as a thoroughly dispassionate display of the facts at hand."

If you are interested in following the criticism and counter-criticism further you will find Miss Goldmark's response to Dr. Drinker's review in the *Journal of Industrial Hygiene*. You will also find there a warm controversy between two of the government's scientific investigators, one of whom comes to the defense of the worsted ten hour plant where he is or has been employed. I mention these matters in order to call your attention to the exceedingly live nature of the problem.

DEMAND FOR SHORTER HOURS ARISES MAINLY FROM DESIRE FOR MORE RECREATIONAL OPPORTUNITIES

The question now arises as to why there should be such a lack of agreement among the various investigators. If the problem of the "proper" length of the work-day were really open to scientific proof one way or the other, such proof ought by this time to be forthcoming. In my opinion the difficulty is a fundamental one. We have been fooling ourselves into believing that by trundling out the impressive paraphernalia of science we must necessarily arrive at the correct conclusion of the larger question. It is our old problem of the scientific vs. the social-ethical level. Evidence on the scientific level will not prove the rightness or wrongness of a problem which strikes at the very foundation of our social structure. We Americans are hard-headed practical people. We want to be shown. So we turn our modern trick of gathering statistics. I am convinced, however, that our friends the British trade unionists are ahead of us when it comes to understanding the real nature of the work-day problem. Just thirty years ago when the eight hour movement was a liver issue in England than it has yet become in this country, Sidney Webb wrote as follows: "The demand for shorter hours of labor has arisen among the working classes, not so much from the conviction that their present hours are injurious to health—though that in many cases is the fact—not so much from the theory that shorter hours mean higher wages—though that theory is in the main sound, but from the strongly felt desire for additional opportunities for recreation and the enjoyment of life."

I should not care to leave the impression that science has nothing whatever to contribute to the work-day problem. Indeed I believe we can even go so far as to predict quite accurately what the application of scientific methods will demonstrate. Considered from a straight production viewpoint there will certainly be figures proving the advantage of shorter hours in some processes and industries, and of longer hours in others. These figures will vary from plant to plant and from process to process. One of the chief determining elements will be the percentage of human contribution, the "handling time" of the Taylor school. Long hours are certainly an advantage (again from the production viewpoint) where we deal with 90 to 100 per cent machine processes. Such jobs cannot be speeded up and shortening of hours means decreased output as Dr. Ver-

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non clearly showed in his Final Report of the Health of Munition Workers Committee. Maintenance of production must here be secured either by additional machines or by a shift system. This problem, as Drury has recently shown, can be laid squarely across the shoulders of management.

Even in the most painstakingly careful studies like that of Ernst Abbé at the Zeiss Optical Works in Jena—which comes as near being really scientific as any that has been made—it is difficult or impossible to evaluate the contributions of actual shortened time and increased efficiency of plant methods. And even more elusive is the psychological influence of shortened hours on the workers themselves.

THE RELATION OF HOURS OF WORK TO PLANT PRODUCTION

Science thus offers no answer to the general question, what is the proper length of the work day. If you ask: "Can I shorten hours in my plant and maintain production and profits and perhaps release the will to work among my employees?" science stands ready to help. The tacit admission on the part of a plant management that greater facilities for recreation and relaxation for its employees may be a sound long time investment is virtually a recognition of the larger social-ethical problem. How completely this larger problem remains unrecognized is strikingly illustrated by a careful reading of the National Industrial Conference Board's Research Report No. 32 on "Practical Experience with the Work Week of Forty-Eight Hours or Less." At first blush one gets the impression that the work week of forty-eight hours or less is a failure for in 87 per cent of the establishments studied the weekly output of workers decreased. A closer study of the facts shows, however, that production was frequently determined by the speed of automatic machines or working conditions were not what they might have been resulting in a large turnover. It is a simple thing to blame the failure of a shortened work-week upon the lessened hours of labor. In reality the fault frequently lies with the management or employees or with both.

In spite of a widespread appreciation on the part of labor of the desirability of a shorter work-week, the basic rather than the straight eight hour day has received by far the greater support. The basic eight hour day permits overtime at time and a half wages. In other words by failing to endorse the straight eight-hour day, as was the case at a recent convention of the American Federation of Labor, labor has weakened its whole position. The advantages of the basic eight hour day are purely economic. It provides a mechanism for increasing wages but fails completely to contribute towards the solution of our fundamental problem. In some quarters the inconsistencies of labor's position are beginning to be appreciated. Mr. Hillman of the Amalgamated Clothing Workers of America has been steadily pushing ahead in the direction of a straight eight hour day. He, for one, realizes the advantages of eliminating overtime.

In the few minutes at my disposal I have tried to point out certain twists that have crept into our thinking on the work-day problem. Some

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of you are wondering what bearing my remarks may have upon industrial health. The relation is fundamental. Industrial health is not limited to human accident and illness statistics. There is a larger health of industry itself measured in terms of stability and clear thinking. The maintenance of this larger industrial health is our greatest safety problem. It challenges the best efforts of labor, capital and management.

CHAIRMAN COLCORD: There are two chairmen of this meeting; the other is Miss Tracy Copp, Chairman of the Women in Industry Section, and she will introduce the next speaker.

CHAIRMAN COPP: When we consider the progress made in this safety movement, I think we may justly feel proud of what it has meant to the big industrial concerns of this country. It is because we intend to continue that progress that we are at this time quite willing to consider new phases of the safety movement, to consider other things as hazards and other things as accidents. A man is incapacitated for work from the effects of injury and also from the effects of disease. This is being generally recognized throughout the country, and the importance of the prevention of the causes of industrial disease is being felt.

There is no one in the country who has influenced this new movement more than our next speaker, Mr. Wilcox.

DUTY OF THE STATES TO INCLUDE DISEASES OF OCCUPATION UNDER WORKMEN'S COMPENSATION

F. M. WILCOX, CHAIRMAN, INDUSTRIAL COMMISSION OF WISCONSIN, MADISON, WIS.

I have been scheduled to discuss the question of the prevention of occupational diseases through workmen's compensation legislation. While I will wish to dwell to some extent upon the probable reduction of so-called occupational diseases by compensation legislation, I prefer to address myself primarily to the question of the duty of the states to include diseases of occupation under workmen's compensation. I prefer, also, in the discussion to refer to these diseases as "diseases of occupation" rather than "occupational diseases,—this for the reason that the term "occupational diseases" has come to be understood as referring to certain types of diseases that are recognizedly occupational in character. I feel that we should think of the program as one involving any disease that grows out of a man's occupation, whether it is typically so or otherwise.

COURTS UPHOLD PRINCIPLES OF COMPENSATION LAWS

It is just ten years since workmen's compensation became a fact in the United States. A year earlier had witnessed the fall of the compulsory New York law, as a result of the decision in the celebrated Ives case. Profiting by New York's experience, elective provisions were in-

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cluded in the acts adopted by the legislatures of the group of states that put over the compensation program in 1911. And then came months of anxious waiting while one after another of these laws was attacked on the ground of constitutionality. The fight was launched and backed by the employer group. Not a bet was missed, not a stone left unturned. not a worth-while argument lost in the one last and supreme effort to block the compensation movement. Finally decisions were announced. Be it said to their everlasting credit, courts met the responsibility. looking forward, not backward. The legislative determination that the cost of industrial accidents should be borne by the industry was upheld.

In the case of *State ex rel. Davis-Smith Co. vs. Clausen*, upholding the Washington act, Judge Fullerton, writing the opinion for the court, said:

"That the statute here in question has the attribute of reasonableness, rather than that of capriciousness, seems incontrovertible. The evil it seeks to remedy is one that calls loudly for action. Accidents to workmen engaged in the industries enumerated in it are all but inevitable. It seems that no matter how carefully laws for the prevention of accidents in such industries may be framed, or how rigidly they may be enforced, there is an element of human equation that enters into the problem which cannot be eliminated and which invariably causes personal injuries and consequent financial losses to workmen engaged therein. Heretofore these losses have been borne by the injured workmen themselves, by their dependents, or by the State at large. It was the belief of the Legislature that they should be borne by the industries causing them, or perhaps more accurately, by the consumers of the products of such industries. That the principle thus sought to be put into effect is economically, sociologically, and morally sound, we think must be conceded. It is so treated by the learned counsel who have filed briefs in support of the auditor's contentions; it is so conceded by all modern statesmen, jurists, and economic writers who have voiced their opinion on the subject; and the principle has been enacted into law by nearly all of the civilized countries of Europe, by Australia, by New Zealand, by the Transvaal, by the principal provinces of the Dominion of Canada, and in a partial form at least by one or more of South American republics. Indeed, so universal is the sentiment that to assert to the contrary is to turn the face against the enlightened opinion of mankind. The common law does not purport to afford a remedy for the condition here found to exist. It affords relief to an injured workman in only a limited number of cases—cases where the injury is the result of fault on the part of the employer and there is want of fault on the part of the workman. For the greater number of injuries traceable to the dangers incident to industry, no remedy at all is afforded. The act, therefore, having in its support these economic and moral considerations, is not unconstitutional for the reasons suggested upon this branch of the argument."

In the case of *Borgnis vs. The Falk Company*, attacking the constitutionality of the Wisconsin act, Chief Justice Winslow, delivering the opinion for the court, used the following language:

"The Legislature, in response to a public sentiment which cannot be mistaken, has passed a law which attempts to solve certain very pressing problems which have arisen out of the changed industrial conditions of our time. It has endeavored by this law to provide a way by which employer and employed may, if they so choose, escape entirely from that very troublesome and economically absurd luxury known as personal injury litigation, and resort to a system by which every employee not guilty of wilful misconduct may receive at once a reasonable recompense for injuries accidentally received in his employment under certain fixed rules, without a lawsuit and without friction."

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Within the legislative chambers, in committee rooms and lobbies, the opponents of workmen's compensation referred to it as class legislation, violative of personal rights and of the right of contract, a denial of legally established common law defenses, theoretical, socialistic, and gave other reasons or excuses why it should not be accepted. How differently the courts viewed this legislation is indicated by the foregoing opinions and others from which I might have read.

MOST EMPLOYERS NOW APPROVE ACCIDENT COMPENSATION LAWS

Much water has run under the bridge in these ten years. At the end of the first year's administration, the Wisconsin commission made a survey of the employer sentiment regarding the law and its restrictions. There were some "irreconcilable"—conservatives, who in their demand for a continuance of time-honored usages, maintained their opposition all along the line. They complained of the monstrosity of a law that required them to pay damages to a man who had been injured by his own neglect. They made no comment on the case of injury by the employer's neglect, which had in other days furnished them with the excuse for attacking some lawyer as an ambulance chaser because he did not allow them to settle the matter directly with the employee. They were still certain that men were going to maim and mutilate themselves in order to obtain compensation benefits. Fortunately for Wisconsin there were few who even then nursed real resentment against the new deal, and there are still fewer now. For the most part, Wisconsin employers expressed gratification at the actual workings of the law and their approval of the manner of administration. Many who had been opposed to the law prior to its enactment expressed the hope that there would be no effort at repeal. They expressed relief because the many dangers that were held up before them when the legislation was pending had failed to materialize, and asserted that actual experience now pretty clearly indicated that they were for the most part groundless.

The other states in which the program was launched in 1911 are reputed to have had much the same experience as did Wisconsin. Since that time nearly every state has adopted a compensation law, and those laws lately adopted have not witnessed such vigorous and confident attacks in the courts as characterized the earlier proceedings.

COMPENSATION LAWS BROUGHT GREATER INTEREST IN ACCIDENT PREVENTION

The usual coverage given by these acts extends protection no further than to disabilities *accidentally* sustained in the course of the employment. The requirement that indemnity for the disability period be paid by the employer, and that he also furnish the necessary medical, surgical, and hospital attendance to cure and relieve from the effects of such accident, has been recognized as the chief incentive to accident prevention work. Not that employers had been theretofore without concern as to the number of accidents, but in the rush of business the responsible heads of the large industrial plants were so engrossed with other matters that they did not know how many were being injured and permanently disabled. The most serious injuries might come to their attention at

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the office through the press; the others were lost. Volumes have been written by men of experience in the safety field, outlining the material progress in accident prevention since 1911, and in these discussions they almost invariably speak of the impetus which compensation liability has given to the movement. It seems almost axiomatic to say that compensation has reduced accidents.

Mr. C. W. Price, General Manager of this National Safety Council, stated, in a bulletin issued by the Industrial Commission of Wisconsin, at a time when he was assistant to the commission in charge of the safety work, that "more safeguards were built and more real safety work was done by the manufacturers of Wisconsin in the year 1913 than during any previous five years in the history of this state".

Recent years have witnessed tremendous growth in safety engineering and organization work, both within and without the industrial plant. The whole field of effort has been wonderfully productive of good. The movement has reduced human suffering enormously, saved many a workman from an untimely death, and spared countless others from the industrial scrap-heap. Further than this, the movement has produced an economic saving in dollars and human energy, the figures of which stagger realization, even in these days when millions and billions are the commonest kinds of terms.

LABOR WILL OPPOSE INCOMPLETE COMPENSATION LAWS

Now as we enter upon another decade, should we not turn this bit of restrospection to advantage? Knowing what these few years just closed have produced for common good, will employers lapse into an era of contentment with the present, just as prevailed amongst them prior to compensation? It should not be. I insist that such early progress ought to be made to the end that this compensation program meets the full purpose declared by the courts to have been its underlying principle. While opposition at first was almost entirely confined to the employer group, I hazard the prophecy that the first organized attempt at repeal will come from the labor group. It will be borne as a protest against half fulfillment of the promise that the loss entailed by injuries to employees as an incident to production should be charged to the production cost, the same as are labor and raw materials and machinery and tools, and that it be borne ultimately as a charge upon the consumer—not 50 or 60 or 65 or 66⅔ per cent of the part of the employee's wage limited by artificial maximums, but compensation on the basis of his approximate wage loss. The employee must always bear the pain and suffering—no mean item in the measuring of damages at common law—and if he takes the responsibility for some small additional percentage calculated to protect against malingering, that is his full share.

In the case of *Borgnis vs. The Falk Company*, Justice Marshall filed a remarkably strong concurring opinion, in which he said:

"The law approved is a very mild piece of legislation. While I would not suggest it is too moderate for now—for that is not within my province—yet I would not indicate that the Legislature responded as fully as it might to the need for a system as directly as practicable, laying the personal injury burdens

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of production upon the things produced, where they belong, as should have been efficiently recognizd long ago, and would have been had the lawmaking power appreciated that it is its province, not that of courts, to cure infirmity in the law."

Compared with the cost of living, the benefits under compensation are, if anything, less than they were in 1911, that is to say, the benefits where influenced by maximum wage limitations have not kept pace with cost of living. These things are being urged upon legislatures, by the friends of labor, and if there be not a wholesome response and a bringing of the laws to the point where they do in fact compensate the injured workman for his loss, he may be expected to propose repeal and to prevent the re-establishment of the defenses of assumption of risk and negligence of a fellow servant. Those defenses, at least in modern times, are unconscionable defenses, and it may as well be recognized now as later that they will never come back.

"The two defenses which the Legislature has thus attempted to take away are not intrenched behind any express constitutional provision, nor were they originally created by legislative action. They were both evolved by the courts. At a time when industries of all kinds were comparatively simple and free from danger, when employees of a common master were few in number and generally acquainted with each other, and when a personal injury action was a rarity, it was thought not to be unreasonable that an employee should assume those simple risks which were plainly before him, and should not be heard to complain if he were injured by the careless act of a fellow workman by whose side he had continued to work when he must have well known the nature and habits of the man. The precedent once made was generally followed, until it became buttressed by a multitude of decisions in practically all of the jurisdictions whose jurisprudence is founded upon the English common law. But, as has been pointed out earlier in this opinion, the conditions surrounding employer and employed have vastly changed during the last half century, and now the Legislature, having become convinced that new conditions call for a change in rules of liability, have declared that such a change shall be made. They have changed the rule established by the courts because they deem another rule better fitted to deal with the problems of the time, or, in other words, because they deem it best to establish a changed public policy. * * *"—(Borgnis vs. The Falk Company.)

With a return to common law liability, free from those defenses, and the adoption of some comparative negligence provision to take the place of the defense of contributory negligence, the workman may be expected to argue that he is better protected than by any present day compensation law, just as do railway employees. It is common knowledge that railway employees stand almost as a unit opposed to the repeal of the Federal Employers' Liability Act, and likewise opposed to the adoption of any compensation law in its stead.

We may also take a lesson from the situation in Missouri. After the first group of states had adopted compensation laws and the other industrial states were giving serious consideration to the question, Missouri employers complacently fiddled along with a genuine "show me" attitude. And now in this day when juries are returning verdicts of $45,000 to $60,000 in personal injury suits, and the courts are refusing to set aside verdicts for technical errors, and Missouri employers "need a compensation law", they find that they cannot get an average act past the referendum because of the opposition of the working classes. Just turn the

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facts over in your mind—employers backing and employees opposing the enactment of a compensation law.

It is to be hoped that present day compensation laws will soon be made to do what they are now all too glibly asserted to do, that is to say, cover the employee's wage loss into the production cost. At present we charge off little, if more than half, the loss to the cost of production and leave the injured man and his dependents to bear the balance.

DISEASES OF OCCUPATION AS WELL AS ACCIDENTS MERIT COMPENSATION

That is not all the story. As heretofore stated, for the most part the laws limit the benefits to those who are *accidentally* injured. As if there was a legitimate reason for charging to the cost of production and thence to the consumer the half or so of wage loss sustained by the workman who falls, perhaps, as the result of his own negligence and sustains injury, and then leave the poor mortal who gave unstintingly of his service in the sandblast room, to carry the burden of the disease that he contracts in his work. I have yet to hear a legitimate reason for the continuance of the policy of limiting compensation benefits to injuries accidentally sustained. I still retain some patience with the man who urges against the whole scheme of compensation, when it excludes all burden for negligence, but when he proclaims from the house top that he is sold to the principle of compensation, it is a convenient conscience that enables him to juggle the phraseology of his kind of a compensation law so as to exclude the disability from disease that comes upon the workman because of the hazard in his job.

In this very gathering place on Monday, it was stated that 75 per cent of all industrial accidents were humanly preventable. Three out of every four occurred because someone was careless or neglectful. It is conceded a large part of them are chargeable to the employee group. We spend vast sums for safety devices and equipment and education and propaganda for the reduction of the number and severity of accidents. The problem of eliminating the diseases of occupation and of preventing that waste of human life and man power is quite as important as that of accident prevention.

Men do not undergo accidental injuries from choice. Naturally they have a desire to save themselves, although their gross carelessness at times makes one wonder. But the diseases of occupation come upon the employee insidiously. He must more largely depend upon his employer to protect him from disease than from accident. His disease comes not, in the main, from the type of neglect which so frequently characterizes his conduct, resulting in accidental injury. It is a hazard which his job—his working place—prepares for him. The disease comes on him unawares, stealthily, like a sneak thief, and takes away his health. He does not realize what is happening to him until it is altogether too late.

EMPLOYER'S RESPONSIBILITY IN DISEASES OF OCCUPATION MORE TANGIBLE THAN IN ACCIDENTS

Moreover, the diseases of occupation come on him while he does his master's work as his master intended it should be done by him. Indeed, the harder he works, the more devoted, the more unselfish the gift of

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service, the mort apt he is to suffer. If he is to have protection, it is his employer who must provide it. While as to accidental injuries a very considerable proportion, probably more than half of the preventable cases, are properly chargeable to the employee group, it is not so as respects the diseases of occupation. The great burden of responsibility for these cases is on the employer. To prevent the waste in this field is as important as any which faces the United States. Nearly all the other highly civilized countries are meeting the obligation with respect to diseases of occupation in like manner as they compensate for industrial accidents. The only conceivable excuse for any state lagging behind in this matter is the same one that held up compensation legislation. I insist that the duty to move in this matter is the employer's, and his failure to do so convicts him of a shammed committal to the principle of compensation for workmen injured in industry.

Some states have made progress. Massachusetts did not make use of the word "accidental" in defining the kind of injuries eligible for compensation, and after some wavering is now consistently holding to the inclusion of "occupational diseases" under coverage of the act. California has stricken the words "accident" and "accidental" from her law and is holding that such action has had the effect of providing compensation benefits for those employees who contract disease from the industry.

SOME STATE LAWS EXCLUDE COVERAGE OF CERTAIN DISEASES

New York and Ohio have recently adopted amendments extending the compensation benefits to certain types of disease mentioned in a schedule. The most serious of all diseases of occupation, tuberculosis, is intentionally omitted from coverage. Furthermore, this omitted type of disease, when it does occur as a disease of the occupation, is the one for which the employer may least rarely escape moral responsibility. Other well recognized diseases of occupation are also left without coverage in these states because they have been omitted from the schedule.

WISCONSIN LAW COVERS ALL DISEASES OF OCCUPATION

The Wisconsin act was amended in 1919 for the specific purpose of extending the benefits under compensation to *every injury and disease which an employee sustains or acquires as a hazard of his particular job.* The language adopted by the legislators made the law four square with the basic principle of compensation, and accomplished the full legislative intent. No Wisconsin employee will ever have occasion to cry out against its compensation law because its legislators took the pains to provide indemnity for the worker afflicted with lead colic or eczema, and worked overtime to frame a schedule distinguished for the diseases of occupation designedly omitted rather than for those gratuitously included. There is no sufficient penalty for the crime of a schedule that intentionally excepts from coverage any disease that is caused by the employee's work.

TUBERCULOSIS COMMONLY CAUSED BY OCCUPATION

The master stroke in these schedules is found in the fact that no recovery can be had for tuberculosis. Thoroughly dependable statistics

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compiled by the Prudential Life Insurance Company from its wealth of experience, prove beyond shadow of doubt that tuberculosis may be as thoroughly occupational in type as anthrax or lead poisoning. Certain occupations are shown by these statistics to be the directly responsible cause for tuberculosis. They group all occupations which expose the workman to metallic dust, as showing the most disastrous results. At ages 25 to 34, inclusive, taking the Prudential group as a whole, of the total deaths, 53.9 per cent were caused by tuberculosis of the lungs, and 8 per cent more were from other respiratory diseases.

The late Frederick S. Crum, authority upon this subject, said: "Specific occupations with exceptionally high mortality from lung disease are cutlery makers, file makers, metal grinders and polishers, brass workers, printers, engravers, tool makers and gold beaters. Metal grinders, polishers and buffers invariably show a high mortality from respiratory diseases as a direct result of their inhalation of metallic dust particles. The peculiar effect on the lungs of metallic dust is described by some writers on occupational diseases as 'grinder's rot'."

The sandblast produces its quota of tubercular victims. The Wisconsin commission heard the proofs in six claims at one sitting. All were employees of one and the same employer. Four had resulted fatally and the others in serious disability. One other fatal case in the same plant was referred to in the same proceeding. All had developed tuberculosis from their work in the sandblast room.

A survey by the Federal Health Service, of 2,000 garment workers in sweat shops in New York, disclosed a tuberculosis rate of 5 per cent, and a further survey of 1,000 steel workers showed a rate of but 9/10 of 1 per cent. Another investigator and writer says: "Tuberculosis is really a protest against bad air conditions just as typhoid is a protest against bad water."

I have perhaps said more upon the subject of tuberculosis than the real purpose of my paper warrants. But if this disease follows as a proximate result of the processes in certain types of employment, and it does, then why do our principal states devise laws to relieve employers from the obligation to compensate the sufferer and his dependents? There is no legitimate reason for it. Under these schedules, if an employee is killed by the inhalation of carbon monoxide gas, his dependents may recover a death benefit, but the dependents of an employee who inhales brass filings, and dies by inches from occupational tuberculosis, must bear the burden alone. There would be quite as much justice in providing by law that the man who can fall from a scaffold without suffering other injury than a fractured rib, can have indemnity, but the man who breaks a leg or an arm must go without it.

GRANTING OF UNJUST CLAIMS UNLIKELY

There are paltry excuses advanced, the principal one being that tuberculosis opens up too wide an opportunity for unjust claims. As if the fact that there is always some man to be found who will make an unjust claim, justified the denial of opportunity for a man with a just claim to prove it and have recovery! As respects diseases of occupation, the

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employer group indulges the same amount and kind of discussion about "unjust claims" and "borderline cases" as marked their attitude toward compensation for industrial accidents. There are unjust claims made, but they fail. The borderline cases can be decided—are being decided every day. The fact that we have such cases to contend with offers no legitimate reason for legislating against the rights of the worker who has a just claim. It is high time we ceased back-pedaling on matters of principle and right, and guarded against the adoption of laws which the laborer assumes to be in response to principle, only to find that they are surcharged with discrimination and miserable avenues for denial of their rights. If I accomplish nothing more at this time than to make you see the miserably unfair, unjust treatment in store for the tuberculous employee under the provisions of some of the so-called "occupational disease" schedules, and commit your mind to the notion of square dealing when your state comes to tackle the problem, I will be satisfied. While these schedules bring benefits to many employees who would otherwise not receive compensation, yet the danger of other states copying this legislative schedule is so great that it may be seriously doubted whether the sum total for human good is really advanced by such enactments.

ADDED COST OF DISEASE COMPENSATION SLIGHT

The giving of protection to all employees who acquire disease as a hazard of their job, as for accidental injuries, besides satisfying a moral obligation to the employee, constitutes a full committal to the basic principle of compensation. Many states have assumed that the additional burden would be a tremendous drain upon industry. In those jurisdictions where any experience has been developed, the proofs have indicated otherwise. In Wisconsin, with over two years' experience, carefully collected statistics show the added cost to be only 1 per cent of that incurred for accident compensation. The average indemnity per case is slightly less than for accidental injuries, but the average medical expense per case is slightly more than for accidents. In the beginning the Wisconsin rate on each classification was increased 1 cent to cover the cost of the "occupational disease" amendment. More recently filed rates have ignored the necessity for any special loading. The other states that have legislated in this field have made very small, if any, loading of the accident insurance rate to take care of diseases of occupation. Proper sanitation of the plant and proper supervision of the employees exposed to dangerous processes will almost entirely eliminate the danger, and where the disease does fasten upon the employee, quick, competent medical attention will cure it within a shorter disability period than usually results from accidental injuries. Employers have been unduly alarmed over the question of the cost of such legislation. The indemnity and medical benefits are small. Attention to the working conditions will be reflected more quickly and more extensively in the reduction of the cost of medical and indemnity benefits for diseases than has resulted from accident prevention work. Benefits under compensation should be extended to cover the diseases of occupation in order to lend encouragement to employers for the maintenance of sanitary working conditions, and

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the adoption of methods for carrying out manufacturing processes which are calculated to protect the worker from any hazard in connection with such processes. It should be done for the further reason that the basic principle of compensation calls for such benefits to the workers just as clearly as in the case of industrial accidents. It will be an evidence of faith in the compensation program.

Preliminary to my discussion of the obligation to extend compensation benefits to employees suffering from diseases of occupation, I referred in considerable detail to the adverse attitude of employers toward the adoption of compensation laws for industrial accidents. I did it not with intent to criticize, but rather for the purpose of bringing to your mind the reason why the employer members of this National Safety Council, and all employers within the states, should take account of the need for affirmative action on their part in procuring full and sufficient legislation. Employers should not be found with respect to this problem occupying the same position as they did with respect to compensation for industrial accidents. They ought to initiate legislation instead of having it forced upon them by public demand. Will you do it, or will you endeavor to block such legislation?

DISCUSSION

CHAIRMAN COLCORD: Mr. Wilcox's paper is now open for discussion. I hope the industrial surgeons here will express themselves frankly and freely on their attitude toward the introduction of a law in their own state, which will pay compensation for diseases of occupation.

CAPTAIN WM. P. WHITE (Lowell Paper Tube Corporation, Lowell, Mass.): Mr. Chairman, I am not a doctor; I am an employer of labor.

The objection to compensation for sickness arising out of industry is mainly not to compensation for sickness that actually does arise out of that particular industry, but to the possibilities of ringing in on industry all sorts of diseases as the result of occupation or employment.

Take the question of influenza. Is that occupational disease or not? Well, you will say that in the case of a man who goes to his occupation and associates with somebody who has influenza the occupation is responsible. With that interpretation of the law, you can tax the occupation for all the influenza that takes place in that plant, whereas, as a matter of fact, the influenza that he obtained might have been obtained in a moving picture theatre.

DANGER OF SADDLING INDUSTRY WITH BURDEN OF COMPENSATION FOR ALL DISEASES SUFFERED BY WORKERS

Anthrax is an occupational disease of certain occupations, but men may get anthrax without being in those occupations. Would you, consequently, if you had a man suffering from anthrax in your mill, consider that he was to be compensated when it might have been the result of a shaving brush? So much disease is of so obscure an origin that physicians who are engaged in studying the history of disease find a region beyond which they can not penetrate. It is for that reason, I think,

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more than for any other, that the employers of labor are reluctant to see enacted into law such wide legislation as would make them responsible for the diseases of their employees.

DR. T. A. MCCANN (General Motors Corporation, Dayton, Ohio): I am for the workingman because I have been a workingman all my life, and I don't think he has had a fair show in the past. At present, in the best manufacturing establishments in our city, he has more than a fair show. The General Motors Corporation told me some time ago that if I turned down any man who was infected with tuberculosis, without any hope of help for his future, they would certainly see to it that I lost my position immediately. So I feel the great bent of opinion of the employing forces of our country is for their men, and I feel that the employers are full of philanthropy and full of interest, and that they want to do whatever they can for the best interests of their employees.

Any of us who have been associated with this work for any length of time know that there are unscrupulous employees as well as employers, who will take advantage of every opportunity to load their burdens on their employers. I have in mind just now a gentleman who escaped, in a scrupulous examination, under a scrupulous examiner. He had a little rheumatic condition in the knee-joint, that the X-ray shows, of an old chronic character. He fell while in the employ of our company and the company is taking care of him, doing everything in the world for him; giving him a sitting position, and looking after his family during the interim of his injury. He slipped off a chair and dislocated his leg slightly, which resulted in the injury.

The greatest health hazard in Dayton, to my mind, is poorly ventilated cars. I want to know if you are going to put the diseases that occur in industry through illy ventilated street cars at the door of the manufacturers in the cities? I only mention that as one. The rounds of the debaucher at night—are their evil effects going to be paid for by the manufacturer? Disease seldom occurs in well regulated shops; and the hardest thing I have had to do since the law has been in active operation in Ohio has been to determine where this particular individual got his trouble. It is a big question and a hard one to solve, and I think my good friend here from Wisconsin is entirely too broad in his application of these laws.

OTHER NATIONS MAKE INDUSTRIES COMPENSATE FOR OCCUPATIONAL DISEASES

DR. ALICE HAMILTON (Harvard Medical School, Boston): I think it is very evident that the sense of the meeting is against Mr. Wilcox, and, without going into the question of adjustments coming under the workmen's laws, diseases of occupation, as he rightly calls them, I should like to call the attention of the audience to the fact that this is not so new and startling a proposal as the audience thinks it to be. This is, after all, the only great civilized industrial country which has not accepted that principle. In all the other countries a large part, if not the larger part, of the expense of diseases of occupation are forced upon the employer (in Great Britain very much the larger part), so that if we find

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it so very strange, so unjust, so preposterous, there must be something about American industries that is different from the industries of other countries. Why should we find it a staggering burden, when the other countries have concluded that it is only a fair and just burden? I think we ought to look into that very carefully before we reject Mr. Wilcox's program. It seems to me that his statements are based on justice and honesty and truth.

CHAIRMAN COLCORD: I would rather dread the day when a law of this kind would be passed in Pennsylvania. We have in Pennsylvania now a very good compensation law, as far as accidental injuries are concerned. I have had to go before the compensation board on many cases of accidental injuries; and occupational diseases, properly such, I believe, are taken care of under that law, though not specifically named in the law; that is, the case of lead poison, manifestly caused by exposure to lead in the works, would be paid for, I think, under our present compensation law.

To open up the whole question of all diseases, not strictly occupational diseases, and allow every sick man who worked for us to come before the board and try to make out that his sickness was caused by something in the mill, would make a bad tangle, it seems to me.

I have men who come to me sick almost daily, who claim that their sickness was caused by something in the mill; for instance, lame backs. They will tell the most ingenious stories about how they got it. Supposing they all could go before compensation boards and ask for compensation (a board not of doctors but of lawyers) where would we be?

The other day a man who had asthma came to me and said he got it from the gases from those works. That man would have come before a compensation board and received compensation.

A typhoid fever case not long ago claimed that he got it from water in the mill. I personally see that that drinking water is analyzed bacteriologically every month, and it is always pure, free from disease germs, so far as we can learn. However, that man lived near a dirty spring and drank from it, and probably got typhoid that way. Yet that man claimed he got it from the mill. The same thing applies to tuberculosis and dysentery, and so on.

I should hate to see this question thrown open to every man with a lame back and asthma, and a vast number of other diseases, so that he might go before the board.

DOCTORS MUST LEARN MORE ABOUT INDUSTRIAL DISEASES

DR. WADE WRIGHT (Harvard Medical School, Boston): I think it would be rather fortunate if there should be some suggestion made before this company, that a certain responsibility rests upon the medical profession to learn more than it now knows regarding the nature of occupational diseases.

In Massachusetts we compensate for occupational disease from time to time, when it can be clearly brought out that such occupational disease is a personal injury.

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It is interesting to note the very serious doubt which exists regarding the authenticity of lead poisoning. Recently one of our supreme court judges, a man who I believe never had a shingle, ruled in a lengthy opinion that (in a certain case, the merits of which do not particularly concern the issue here) pain is not disease, and disease producing pain is not a personal injury. The case was ruled out and a handsome precedent established upon our records.

It is the inadequacy, the inefficiency, very often, of doctors doing their best, which I think is responsible for so much of the confusion which exists in all our states, as one may readily find out by a perusal of some of the decisions of various cases that come up for decision in various state courts.

We do not know very much about occupational diseases. The doctors alone can not find that out; they must have the co-operation of industrial managers and employees. Industrial medicine is a great public health problem.

MR. WILCOX: Mr. Chairman, I want industry to bear only the things that it causes; nothing more. I don't ask that every man who shall have a disease and be disabled, shall have compensation from industry, unless he can establish his right to have it from industry; and for the most part, with some very few exceptions, like tuberculosis, it is not a difficult matter to establish.

I don't believe that every person who had influenza and who happened to be at the time working in some man's plant should have compensation for it; or that his beneficiary, in case of his death, should claim death benefits; but, if a nurse in a hospital, charged with the responsibility of nursing all the influenza patients who came to that hospital, suffers from influenza, I submit that the chances were that she got her influenza by reason of her occupation, and I would compensate for influenza under those circumstances.

Captain White speaks of anthrax. Anthrax occurs in the hide and leather industries. We have had some anthrax cases. Have you ever personally known of one that got it from a shaving brush?

CAPTAIN WHITE: It is so reported.

MR. WILCOX: Oh, yes; to be sure! In the leather industry, where one is more apt to get the disease than anywhere else, shall we start arguing that a man probably got that anthrax from his shaving brush, although he is handling hides all day long for weeks and months and perhaps years? That isn't the way that these things occur.

COMPENSATION FOR DISEASES IN WISCONSIN ONLY $25,000 OF A YEAR'S TOTAL OF $2,500,000 COMPENSATION BENEFITS

I assume full responsibility for the Wisconsin act, and I never experienced a prouder day that when I heard I was to administer it. I have administered it since the sixth day of July, 1919. Let me say to you employers who are fearful about this law, which covers all of the diseases of occupation, that that law administered total benefits in 1920 of $2,500,000 and of that total the indemnities for men injured by diseases

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of occupation were only $24,873—and included in those figures are two cases in the hide and leather industry where a man went down into a vat and was killed by carbon monoxide poisoning. We would have compensated in those particular cases independently of this act, but, as I said, we are bringing all of those into one tabulation. So just think of it: About $15,000 to $18,000 in the great State of Wisconsin, out of $2,500,000 indemnity! Here, my employer friends, is where you will play clear on this: follow the suggestion of this doctor from Harvard, that physicians should know what diseases industries cause, and know how to combat them.

While medical benefits in these diseases of occupation in Wisconsin have been much higher than the average for accidental injuries, it simply goes to prove that, having the responsibility for taking care of those things thrust upon him, the employer now looks out for his men. If the man is a sand-blast operator, when he commences to show signs of ill health, he is taken care of; the doctor gets on the job before the disease takes hold of him. As an example, take the TNT poisoning during the war. Nobody had to die from TNT poisoning, if he was taken care of properly.

If the doctor from Ohio will learn the diseases of occupation and learn what the symptoms are, and be ready to treat them when they occur, he will save the compensation for the employers.

Dr. G. F. N. Schram (Fairbanks-Morse and Company, Beloit, Wis.): I think the trouble comes entirely from the inability, irrespective of our knowledge, always to be sure where the man got it—that refers both to injury and to disease. Time and time again, if you go through my records in Beloit, you will find: "Foreign body in the eye—probably at work." We make that notation continually where the theory of chances rules that the man got it in the shop. When he comes in with a cold he usually says, "I don't know where I caught it." If he comes in with a headache, he is asked what caused it. It doesn't make a bit of difference what his complaint is, he doesn't know. Now, if he doesn't know, and if he has been off the job and had a physician, and is feeling fine when he comes in, I don't know how you are going to get the cause and decide in a way so as to make it equitable for the man and for the insurance carrier.

Chairman Colcord: Dr. Donald B. Armstrong will next address us.

WHAT HAS BEEN DONE FOR THE HEALTH OF THE INDUSTRIAL WORKER IN FRAMINGHAM?

Dr. Donald B. Armstrong, Executive Director, The Community Health and Tuberculosis Demonstration of the National Tuberculosis Association, Framingham, Mass.

The industrial relationships and contacts of the Framingham Community Health and Tuberculosis Demonstration have been extremely important in the development of the Framingham program. These industrial factors constitute the chief consideration of this paper. Perhaps a

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preliminary word, however, with reference to the character of the demonstration in general may be helpful.

The Framingham experiment or demonstration has now been under way for nearly five years, under the auspices of the National Tuberculosis Association, financed by a special contribution of $150,000 to $200,000 from the Metropolitan Life Insurance Company. This demonstration has aimed to answer certain pertinent questions in the tuberculosis field, such as: How much tuberculosis is there? What is the best way to treat it? How best can a community be organized for the eventual control and elimination of the disease?

Naturally, the demonstration has had an intense interest in industry, as it is in the industrial age group that the highest tuberculosis death rates are usually found. Certainly, tuberculosis is in part at least an industrial disease.

ACTIVITIES OF THE FRAMINGHAM DEMONSTRATION

A few of the more important activities of the Demonstration may be briefly listed as follows:

1. A general and sanitary survey, including a survey of industrial hazards.
2. Extensive medical examination campaigns, covering a large fraction of all age groups, including industrial workers.
3. An expert consultation service for the diagnosis of tuberculosis, offered to private physicians, factory medical and nursing staffs, etc.
4. The thorough organization of the community itself, not only for tuberculosis control but for general health and disease preventive work, including the fields of general community sanitation, infant hygiene, school hygiene, and industrial hygiene.

RESULTS OF DEMONSTRATION

A few of the more important results of the demonstration, from the general as well as from the special industrial viewpoint, may be briefly discussed:

1. The examination of a representative population indicates that about one per cent are suffering from active tuberculosis.
2. A thorough search for tuberculosis cases indicates that there are nine or ten active cases of the disease in an average community to every annual death from tuberculosis.
3. Adequate medical machinery in schools, factories, and elsewhere is essential to the detection of tuberculosis.

A full time physician for every 2,500 school children or factory workers is essential. The first consistent medical examination work of the school population of Framingham (about 3,000) disclosed 11 cases of active tuberculosis and 69 suspicious cases hitherto undetected. The establishment of adequate medical machinery in the factories increased the percentage of new cases annually discovered through the factory medical machinery 27 per cent over a period of three years.

4. The average community does not report more than 55 per cent of

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its active tuberculosis in an early stage. Framingham experience has indicated that this percentage may be raised to 85.

5. The percentage of active cases receiving institutional care has been raised from 13 to 42 per cent.

6. The total health appropriations from both public and private sources have increased from $0.40 to about $2.00 per capita per year, the latter figure being set as an approximate standard for adequate community health work.

7. What will adequate machinery accomplish toward tuberculosis control and mortality reduction? Starting with a tuberculosis mortality rate of 121 per hundred thousand as the average for the ten years preceding the demonstration, the rate fell to approximately one-half of that figure (64 per hundred thousand) in 1920, and present indications forecast a rate possibly in the neighborhood of one-fourth of the pre-demonstration rate for the current year (1921). This would indicate that the same measures, applied throughout the United States, would result in a saving of nearly 100,000 lives a year.

EFFECT UPON LOCAL INDUSTRIES

To return to the more important industrial considerations, it may be stated that there are in Framingham approximately 5,000 industrial workers. By far the largest industry, employing approximately one-half of this total, is a paper products plant where tags, boxes, and crepe paper products are produced. Other industrial interests include carpet manufacturing, boiler construction, foundries, shoes, automobile bodies, etc.

The demonstration's approach to this problem has included two main efforts: first, a thorough survey of the industrial hazards of the community, carried out with the co-operation of the Massachusetts Board of Labor and Industries, the former New York Museum of Safety, and the New York State Commission on Ventilation—followed by an effort to correct the fundamental dangers to industrial workers; and second, an effort to encourage the local industries themselves, with necessary co-operation and aid at the start, to provide an adequate medical, nursing, clinic and dental personnel for the industrial employees.

On the side of personnel, when the work started there were employed by industries in the community one nurse and one part-time safety engineer. As a result of the co-operation which the industrial plants have given the demonstration during the past four years, it is now safe to say that between 70 and 80 per cent of the industrial workers are under reasonably adequate medical, nursing and clinic supervision. The experience in the largest plant in the community, employing approximately 3,000 workers, is particularly illuminating from the point of view of employee interest in, enthusiasm for, loyalty to, and sympathy with the purposes and objectives of the medical and nursing program. This plant now employs a full-time physician and two nurses, and maintains an excellent clinic and first-aid establishment. The plant is organized on an advanced democratic profit sharing and management sharing basis, with consider-

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able participation in control by employees of different grades, through industrial partnership, industrial associates, and shop committee devices.

COMPULSORY MEDICAL EXAMINATIONS APPROVED BY WORKMEN

This relationship between management and employees introduces certain novelties into the development of medical and nursing policies which might have seemed to a short-sighted view to be obstacles in the beginning, but which have in reality only more firmly established the foundation for the program as a whole. Take, for instance, the matter of compulsory examination of new employees. It was not impossible to convince the management in this plant of the validity of the employment of its medical and nursing machinery for this purpose. After they were convinced, however, it was then necessary to convince the shop committee. Fortunately, the expert constultant of the Health Demonstration, Dr. F. C. Bartlett, has always worked in close co-operation with the medical service in this plant, and, with their help, was able, by effective case histories of individuals ill with dangerous communicable diseases as found in this industry, to illustrate the importance of detecting such affections at the time of initial employment. The principal of compulsory examination was approved and was put through, with the backing of the management and of the men.

The members of the shop committee, employees in general, and the management, are now enthusiastic over the operation of this rule. It was

While the Framingham experience has been on a relatively small scale, it has, nevertheless, been an intensive experience and may perhaps be legitimately used to suggest certain tentative standards for industrial medical work at large. It may even be possible to propose certain quantitative as well as qualitative standards. For instance, for an industrial unit of 2,500 people it would seem that there would be required at least one full-time physician and two full-time nurses, an adequate clinic equipment, some dental provision, and at least part-time arrangements for safety. While the work of the medical and nursing staff may with advantage be organized as a fairly autonomous unit, it should of course be very closely related to certain other factory interests, such as the employment manager service, the personnel division, the insurance or pension department, educational work, welfare or recreation activities, etc.

FUNCTIONS OF MEDICAL DEPARTMENT

Some of the functions of the medical and nursing staff might be stated as follows:

1. The routine operation of the first-aid facilities and clinic, including the care for minor injuries and ills.
2. The diagnosis of chronic affections, with their reference to outside physicians of the individual's own choosing for continued treatment.
3. General health education by means of literature, lectures, bulletins, etc.
4. General safety work, machine guarding, etc.

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5. General plant sanitation, including such matters as ventilation, cleanliness, water supply, etc.

6. Special class instruction, as, for instance, for groups of girls working on special types of machines, for whom group teaching in personal hygiene may be provided, covering such matters as posture, diet, clothing, recreation, etc.

7. Particular medical advice with reference to working and living adjustments for department heads and more responsible employees in the managerial class—a sort of local intensified life extension service.

8. The regular examination of all new employees, in co-operation with the employment department.

9. The regular periodic re-examination of permanent employees.

CO-OPERATION OF WORKMEN ESSENTIAL

As indicated previously, it is our belief that medical and nursing facilities in industry can only be used to their full advantage if they are developed and operated in close co-operation with the labor groups concerned. These facilities must be used with a primary object of fitting the man to the job, and not as a device for the rigid elimination of the unfit from industry. It must be recognized by all that through the adaptation, or possibly the elimination, of a few will come the protection of many. It is probably unnecessary to say that such medical and nursing provision is a legitimate routine charge upon the industry, is indeed a thoroughly profitable investment, and should not be considered at all as philanthropy which the employer provides for his employees.

Properly organized and promoted, an adequate medical and nursing service in industry will substantially decrease loss to the industry as a result of illness prevented, labor turnover reduced, etc. If the industry not long after its application that the men themselves were asking: "If this is good for new employees, why isn't it good for all employees on a regular basis?" In fact, the next step has now been taken, and a system of regular periodic medical examinations for all employees, graded on the basis of age and period of employment, is now being experimented with.

CO-OPERATIVE MEDICAL SERVICE FOR SMALL PLANTS

Two or three others clinics with full-time nursing and part-time medical arrangements, in one instance with compulsory examination of new employees, have been developed in the community, and a plan promoted for the provision of a co-operative medical and nursing service for several of the smaller plants unable to provide full-time service for themselves. The actual establishment of this service is now dependent upon the more extensive revival of industrial activities.

is intelligently organized on the basis of purposeful service, with the rational fundamental distribution of authority and responsibility, and with the necessary concomitant participation of workers in control, the medical service will be as useful as any other single device for enhancing the loyalty and devotional morale of the entire industrial group concerned.

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Adequate industrial medicine is an integral part of any decent physical foundation for the righteous industrial democracy.

DISCUSSION

CHAIRMAN COLCORD: Dr. Armstrong's paper is now open for discussion.

DR. R. E. ANDREWS (Ludlow Manufacturing Association, Ludlow, Mass.): I was very much interested in Dr. Armstrong's paper, particularly his organization of the medical department for an establishment of perhaps 3,000 employees. The thought occurs to me that the difficulties that we are experiencing will probably be the same in the organization which he lays out for the physical re-examination of the employees. If he lays out his staff for one full-time physician and two full-time nurses and has periodical examinations of his employees, his physician is going to be re-examining all day long for 365 days in the year, without completing those 3,000, presumably, if those statistics are made according to the standard usually accepted. I believe if that is to be thoroughly carried out, it will require a staff of at least three or probably four full-time physicians.

I think the criticism might be raised that, barring the re-examination of incipient cases, re-examination should be confined to those who on re-examination have shown some signs of slight disability or medical impairment. Otherwise, I can't see how the work could be thoroughly done.

DR. H. J. MURRAY (Dennison Manufacturing Company, Framingham, Mass.): Dr. Armstrong said that we were experimenting with the periodical examination of all employees. At the present time we examine every employee who comes for employment; and when he spoke of experimenting, I think he referred to the examination of all persons who were transferred within the factory from one job to another, except the clerical force, to see whether they were fit for the new work into which they were to go. We have no regular periodical medical examinations as yet. If we did have, it would take more than one full-time physician.

CHAIRMAN COLCORD: I would like to ask how you handle the so-called "sub-normals". I suppose you group your employees at the first examination into two groups—normals and sub-normals. Then what do you do with the sub-normals? Do you examine them at any regular time or do you treat each as a separate problem?

DR. MURRAY: At the present time they would each be considered as a separate problem; that is, if we consider their defects of enough importance to their health to require examining them within a month or a year. Such defects as teeth or bad tonsils, unless they were under seventeen years of age, we wouldn't follow up again, under the present system; but all boys and girls under seventeen are examined every six months. That is another phase of the work which has just recently been started. Unless a defect was important enough, in our opinion, to affect the man's health within a year's time, we wouldn't ask him to come for re-examination.

DR. A. B. EMMONS (Boston, Mass.): I would like to ask Dr. Murray

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a question. I understand that you have a method of examining the group of managers. I should like to know how that works out; how you have arranged it—whether that is to be an annual affair or periodical?

DR. MURRAY: The idea of examining all the persons in managerial positions, that is, people in executive positions, was started by Mr. Dennison, and he had Dr. Baldwin, who has been his personal physician for some time, do this work. This work is done entirely by Dr. Baldwin, who comes down to the factory about four or five mornings a week, and these executives are examined at least twice a year, and more frequently, if Dr. Baldwin thinks it necessary. He also recommends extended vacations or periods of rest for any of the executives who seem to be subnormal or under par, and gives them medical advice generally. This has been going on for about a year and a half and I believe the results so far are well justified and it can probably be carried right along. Dr. Baldwin supervises the health, really, of all the executives of the plant, and there is no set time for any of the executives to be examined but they are examined when he thinks it is necessary for them to be.

ADJOURNMENT.

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A B C Session

September 27, 1921

S. H. KERSHAW, Chairman
Fire and Accident Prevention Engineer, Hercules Powder Company, Wilmington, Del.

CHAIRMAN KERSHAW: It is certainly gratifying to see so many delegates present at this meeting this afternoon, when you consider the present conditions existing throughout the country. The first paper on the program is by Mr. G. E. Sanford.

FUNDAMENTALS OF SAFEGUARDING

G. E. SANFORD, SAFETY ENGINEER, GENERAL ELECTRIC COMPANY, WEST LYNN, MASS.

This subject, "Fundamentals of Safeguarding", might be interpreted in two ways: one, "how to manufacture safeguards", the other, "how to keep your employees from getting injured". Many of you are undoubtedly just getting into the safety game and for that reason may give undue prominence to the first mentioned side of this subject. The parts which are most commonly guarded are the power transmission machinery parts and accidents on these are very infrequent, although generally severe. I do not wish it understood, of course, that I am advocating the slighting of machine guarding, but I wish to impress it on your minds that there are other features of safeguarding which are very important. Some time ago I made an analysis of lost time accidents for the year 1920 in five large manufacturing plants aggregating in that year approximately 45,000 employees. The power transmission machinery caused four-fifths of one per cent of all lost time accidents in those plants, while the handling of material, without any machinery of any description being involved in the handling, accounted for upwards of 30 per cent of lost time accidents. Those same plants have been in active safety work for a number of years. I was able to get hold of the accident statistics of them for the year 1913 and found that while the aggregate number of accidents in those plants had been materially reduced from 1913 to 1920, the percentages remain very nearly constant for the several items.

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When a machine is received in your plant the millwrights are usually able to get it set up ready to put in operation more quickly than you can manufacture permanent guards for the dangerous parts of the power transmission, and in place of allowing your machine to run for several days—sometimes several weeks, without guards of any description—I would recommend the use of portable guards, such as the pedestal shown in Figure 1, the base of which is of heavy cast iron, holding a piece of pipe approximately five feet high, with brackets on the pipe, so that pieces of board can be laid across from one pedestal to another. That type of guard is quite effective. The pedestals can be stored when not in use in a comparatively small space and the outfit can be very quickly assembled when needed. This type of guard is also very useful when it is necessary to excavate a ditch near some passage way in the yard.

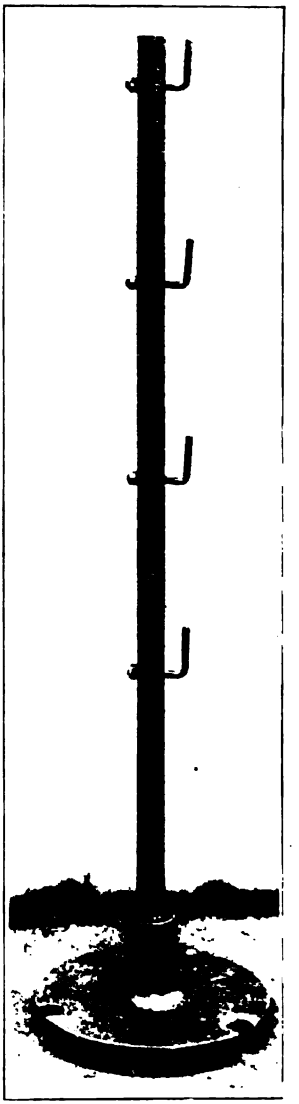

FIGURE I

CONVENIENT METHOD OF LAYING OUT BELT AND PULLEY GUARDS

In the manufacture of permanent guards for belting it is our custom to use expanded metal on an angle iron frame. The table as shown in this picture (Figure II) is arranged so that forms for varying sizes of pulleys can be placed on it at the proper center distances and the angle iron frame work for the guard is bent and assembled directly on that table using those forms. This is not only a very convenient method of making up the frames, but also allows the mechanic who makes them to use a minimum of dimensions from the parts guarded and does not require the drafting department to furnish a sketch before the mechanic goes to work. The expanded metal for such frames should be placed against the inner portion of the angle iron so that there are no sharp edges to stick out and tear the clothing or skin of some passerby.

In some cases guards made in the form of hand rails with one or more intermediate bars are covered with expanded metal on framework. It is our custom to fasten the edges of the expanded metal between two pieces of bar steel and suspend the combination from

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the top bar of the fence by means of hooks, the lower hooks being bent just enough so that they will spring around the lower horizontal member of the fence. This fence screen can be removed without the use of tools

FIGURE II

and when taken off to adjust a belt or other part of the machinery is much more easily replaced than is the kind which requires the holding up of a heavy screen while some other individual puts a bolt through the supporting bracket.

The workmen should, however, have the fact brought forcefully to their minds that while the power transmission part of the machinery can be guarded very nicely in most cases, still there is frequently a hazard at the point of operation which cannot be readily guarded and the operator should never lose sight of the fact that the machine is still dangerous at such places. Some individuals seem to think that as long as a machine is well covered with an assortment of guards over the belts, gears, etc., it is fool proof; at least some of the accidents which occur on such machines would lead anyone to that version of the matter. For example, a single spindle upright drill may be thoroughly guarded at all points except the actual drill-spindle, and yet if a man wears a long flowing necktie, that necktie may sooner or later wind around the drill point.

Practically every shop has one or more grinders and we find those grinders in all shapes and places, sometimes with a band guard around the wheels and sometimes with the guard removed by someone and its location unknown. In manufacturing guards for wheels, care should be taken that whatever stock is used should be sufficiently heavy so that pieces of the wheel may be retained in the event of the wheel bursting.

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Another thing which may happen in a shop where grinders are used is that some individual with a false sense of economy will use a wheel until it is worn down to the flanges; then will remove the nut and the outside flange and replace the nut with possibly only a washer or a small flange on the outer end of the spindle. This makes an uneven pressure on the center of the wheel which is likely to crack; not so much so, possibly, on the worn down wheel, but if a new wheel is put on and uneven flanges are left I could almost guarantee to break a wheel mounted in such a manner, and a strain will undoubtedly be set up in the wheel which would cause it to burst sometime when it is running.

A lathe can be guarded at all points except the point of operation. I know of one case where a young man was operating a well guarded lathe. In the shop where he worked it was the practice to go so far in lathe guarding that the lathe dogs were guarded as well as the gears. Yet that young man, apparently with a sense of security on account of so many guards on the machine, picked up a handful of waste and attempted to wipe the shaft which he was turning while the shaft was revolving. The waste caught, also his hand, and he was quite seriously injured.

EYE PROTECTION ONE OF MOST IMPORTANT FUNDAMENTALS

Another point which many of you will have to contend with is the protection of a man's eyes. You can sell a man a glass eye, but he can't see out of it, and many eye protectors which are given out in the factory are handled in such a manner that their use cannot be made possible. Some goggles have to be fitted to the workman on account of frames being stiff or semi-adjustable and it is a very unsatisfactory thing for one of these operators to try to adjust a pair of goggles to fit his face, as he does not know how to go about it. When a man requires goggles he should be given them in such a way that he realizes that his superiors are interested in making him as comfortable as possible under the circumstances, and I would recommend that a man be given a choice of two or three good varieties of goggles if one which is given to him does not seem to suit his particular facial characteristics. Interest in the wearing of goggles can be maintained by posting on bulletin boards goggles which have been smashed in local service with a memorandum of the man's name, or better still, his photograph with the goggles. Such always attracts attention and it has been my experience that such methods are very good in inducing workmen to wear the goggles. I have used on such bulletin service a group picture of fourteen employees of the chipping department of a large steel foundry, every man in that group having had at least one pair of goggles smashed over his eyes while in use and one man in that group had a record of smashing eight pairs of goggles in eight and one-half years' continuous work. It is a very rare thing to find a chipper or grinder in that plant with his goggles on his forehead or in his pocket.

Personal caution is the greatest safeguard of all. That must be kept in mind, in addition to the providing of safeguards or other tools which the man carries with him or works with. It is not enough to make a

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guard for a machine and then to assume that everybody working on that machine is going to be safe forever after. They may not. There are times when personal caution must be used.

DISCUSSION

MR. SANFORD (in answer to questions): I don't consider it necessary to use both goggles and a glass guard, on grinding wheels. If a guard is used, the frame holding it should be so constructed that that glass can be readily slipped off. If you have to depend on a screw driver and wrench to take out a half dozen screws in order to take the glass off, you may not change it until it gets in a condition where it is impossible to see through it, and you find your man looking around the edge of it. For a 12-inch machine I should use about a quarter inch plate glass. This will withstand the impact of the particles of emery. I don't believe that a piece of wire glass will hold one of those wheels when it lets go.

MR. D. C. HUNTER (National Cash Register Company, Dayton Ohio): In 1918 we had goggles at every emery wheel in the factory, but the men were not using them, so we installed glass guards. We do not use an ordinary glass or plate glass, but a non-shatterable laminated glass.

MR. A. ROUSSEAU (Norton Company, Worcester, Mass.): The thing to remember in designing guards of any kind is to properly proportion the material of which the guards are made with due respect to the work which they will be called upon to do; for instance, a steel guard which is too thin or designed improperly, may not serve its purpose; likewise a guard made of cast iron or of wood, if properly proportioned, would retain the pieces of the driving wheel and properly serve its purpose.

CHAIRMAN KERSHAW: The next paper is by Mr. R. C. Salisbury.

GETTING RESULTS FROM PLANT SAFETY COMMITTEES

R. C. SALISBURY, SUPERVISOR OF SAFETY, INTERSTATE IRON AND STEEL COMPANY, CHICAGO

In introducing a topic of this nature, it is quite essential to have in mind the various bodies falling under the general heading, plant committees. The arrangement to be followed in this paper is the designation of each of such committees and an elaboration of their uses and functions.

In the several plants of the Interstate Iron and Steel Company, as is quite uniformly true of all steel mills, the committees embrace the following: the workmen's safety committee, accident investigating committee, chain and cable inspection committee, plant safety committee and the foremen's safety committee.

WORKMEN'S SAFETY COMMITTEE

The workmen's safety committee consists of a varying number of men chosen by the foremen. It is important that the foreman, in choosing the members of this committee, should appoint the most intelligent

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and responsible workmen under his supervision. A fair understanding of the English language is a requisite. Men of this committee are called together by the safety department, lectured and given instruction on safety rules and safe methods of performing their work. This instruction should be concrete and reference should always be made to actual occurrences and accidents which come under their personal observation. The members of this committee should be looked upon by the safety engineer as missionaries for the promulgation of safety doctrine among their fellow-workers. They must act as teachers to the less intelligent and alert of their companions and give especial attention to those who are not conversant with the English language. This last especially is important where plant linguists are not available. One of the most important functions of this committee is to initiate and enlighten the new employee, pointing out to him dangerous practices to be avoided and such general plant hazards as cannot be eliminated from his work.

ACCIDENT INVESTIGATING COMMITTEE

The accident investigating committee consists of the technical men of the plant—the chief engineer, chief electrician, master mechanic and safety engineer.

This committee, as its name indicates, investigates all accidents of a serious nature. Consisting as it does of these responsible men it will function without any unusual stimulus and if a stimulus were needed it is found in the excitement and interest that is occasioned by the accident itself. The findings of this committee and its decision upon the cause of the accidents are of vital importance in the prevention of accidents. The most important function of this committee is to provide accurate details and data concerning each accident. Such data should be put into the form of a permanent record and preserved by the safety department. Such records have a value not only for statistical purposes but they are sure to be called for by the law department in the event of controversies.

CHAIN AND CABLE INSPECTION COMMITTEE

The chain and cable inspection committee is appointed by the master mechanic and usually consists of three men. In the case of the Interstate Iron and Steel Company these three men are riggers who by reason of their experience are well qualified in detecting flaws and faults in chains, cables, ropes, blocks and tackles and hooks. They are not, however, necessarily familiar with the tensile strength of such equipment. For this reason in order to obtain the best results from this committee the safety department must spend some time with its members, preferably, prior to each of their weekly inspection tours. In this informal talk the men should be examined on their knowledge of safe loads, breaking strains and lifting capacities. The efficiency of this committee may be ascertained from the nature of its reports to the safety department, which should check them over carefully and give them the attention commensurate with their high degree of importance.

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PLANT SAFETY COMMITTEE

The plant safety committee needs but brief comment. It is the accident investigating committee, except that its personnel includes the general superintendent and local auditor. This committee meets in session as occasion demands, but regularly once a month. It is the supreme court of the safety organization. It functions quite automatically, but it also provides a forum for the display of the force and persuasiveness of the safety engineer who must needs come before this body with his requests for new devices and equipment. It is this committee that takes up in detail the Safe Practices pamphlets issued by the National Safety Council.

FOREMEN'S SAFETY COMMITTEE

Among the safety committees there is none so important, in my opinion, as that composed of the foremen. Its importance must be manifest to one who reflects upon the close contact between the foremen and workmen under their supervision and control. Although the foreman is primarily interested in the *efficiency* of his men, *efficiency* is best advanced by the maintenance of the *safety* rules. No one should be made so fully aware of this fact as the foreman. The temporary disablement of an employee, or his loss by reason of an accident, is immediately reflected in the production of the foreman's department. His interest to prevent accidents is therefore stimulated by a most powerful motive, namely the motive of self-interest. This stimulus may be accentuated by actually charging the expense of accidents to the operating costs of his department. With this in view the safety department should co-operate with the auditor and superintendent in the compilation of statements to be presented to the foremen at their meetings, and such statements should clearly show how his own department is involved in expense by reason of accidents occurring there. Occasionally this committeee is called upon for tours of inspection, and when this is done the entire plant is covered and a careful search made for physical hazards.

In conclusion it will be observed that the committees herein named and discussed are merely a means by which the workman is educated in accident prevention work. The goal of the safety engineer is the prevention of avoidable accidents. The organization of committees is the means of attaining that goal. The problem of insuring the effective functioning of these committees and obtaining desired results through them is to discover the prod or stimulus that will move the members of the various committees to action. Here as in other fields of human activity self-interest is the most powerful of motives, and a safety engineer will obtain the best results from the plant committees by an effective appeal to that motive.

DISCUSSION

MR. N. M. DU CHEMIN (General Electric Company, Lynn, Mass.): We have combined the employees' committee and the executive committee and thus get the best results. In an employees' committee the recom-

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mendations are usually irrelevant, while a committee composed solely of executives is apt to lose touch with the rank and file.

On the joint committee we have both sides represented. If a workman has a suggestion to make, there are those on the committee who can see it through to a successful conclusion, or can explain to the workman without delay why such a policy is impracticable.

Having worked on the shop committee, the workman is reasonably sure that statistics running through that committee are accurate, and is willing to recognize that 75 per cent of accidents are due to lack of education, thoughtlessness, or plain carelessness on the part of their fellow workmen. The delegates representing the workmen are our big force in dealing with the human element and they can bring the message back to the man in the shop and put it over very much better than any foreman or safety representative of the factory can possibly do.

Our general committee is composed of five men elected by the employees, and five representatives of the management. Then in each shop where there are eight hundred to a thousand employees there is a smaller committee of six members; three representing the employees, and three representing the management. Those shops are divided into departments where there are smaller committees.

IMPRESSING SAFETY UPON MEN AT TIME THEY ARE HIRED

MR. MANSFIELD (State Department of Labor, Pennsylvania): The greatest asset to a safety committee is the employment agent. When a workman applies for employment at the plant, he should be given to understand that the plant is being operated on a safety basis. If that is done, and he is informed that there is a safety committee within the plant which is going to keep a close watch on him and report back to the employment agent, that man is going to get the first impression that it is the desire of the employer to have his plant operated without accidents.

MR. W. A. DOUGLAS (General Electric Company, Lynn, Mass.): When a new man comes into the shop, he is turned over to the "instructor," whose duty it is to show him the dangerous parts in the working of his machine. And through that, I can safely say, we have cut down our accident record 55 per cent. There are about ten or twelve instructors in one department. Each man takes care of certain occupations. Generally he is given five men and it is up to him to look after them until they are instructed as to the dangerous parts of the machine which they will operate. If the instructor finds out that they have been careless in running that machine, he notifies the foreman.

CHAIRMAN KERSHAW: Does there appear to be any friction between the foreman and these instructors at any time?

MR. DOUGLAS: No friction at all.

MR. PHIL STREMMEL (National Enameling and Stamping Company, Granite City, Ill.): I listened with a great deal of interest to Mr. du Chemin's description of a committee made up of executives and men in the shop. That point does not appeal to me. I see in it this danger—

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that men knowing that executives are on that committee, may want to be on the committee not because they are interested in safety, but because they see in it an opportunity to get in closer touch with the powers that be.

CHAIRMAN KERSHAW: What do you think of the idea of approaching your foremen and telling them that they have got to accomplish results in the prevention of accidents and advising them to appoint committees in their own department and have those committees report through them to the management or a central committee?

MR. STREMMEL: If you have a safety engineer in the plant, I would say no, because that is really the duty of a safety engineer and he should select his committee.

MR. COFFEY: We have gotten good results from a factory fire department made up as a rule from the mechanical department, machinists' department, electricians' department, and one or two men scattered around the plant. We have monthly meetings and it is surprising to see the results of the reports that this fire department turns in. Everything from a fire hazard standpoint is incorporated in this report. This fire department is under the direction of the safety committee.

MR. J. D. JAMES (New Jersey Zinc Company, Palmerton, Pa.): Since 1912 we organized what we call a general plant safety committee with members from the different departments. No official in the plant is connected with that safety committee; if there were, the laboring man might consider him as his superior and would be afraid to make suggestions. The safety engineer is in charge. Once a week we give them as much of the plant to inspect as they can cover in three hours. They are encouraged to call attention to anything that looks dangerous to them.

The engineer and his secretary go along with this committee, and every suggeestion made is kept on record on special blanks which are sent directly to the superintendent of the department. He is supposed to give attention immediately, and have that dangerous place guarded. Possibly once every six weeks this committee makes a reinspection.

We make this tour and inspection for a part of the day, and then in the afternoon we give all of these men a thorough training in first-aid work. In that way we have fifty first-aid men all over the plant.

CHAIRMAN KERSHAW: The next speaker is Mr. J. F. Tinsley.

THE ESSENTIALS OF A PLANT SAFETY ORGANIZATION

JOHN F. TINSLEY, VICE-PRESIDENT AND GENERAL MANAGER, CROMPTON AND KNOWLES LOOM WORKS, WORCESTER, MASS.

There is an old truism in industry that a method or system is only as good as the humanity which directs it. The human element after all is the vital force that makes for results and in no line is this true more than in plant safety work. I want to stress at the very outset the importance of building a plant safety organization about individuals who have, either by natural instinct or by acquisition, the real safety spirit.

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There will be found in every plant men who seem to have, intuitively, a natural tendency in this direction, and who are always ready to assist in every way they can to help their fellow men. A selection of men of this type to form the first safety organization in a plant will do more to establish firmly and effectively the safety idea than can be done through an organization following less natural lines.

To do pioneering well one must be a missionary, and a missionary must have unfailing belief in his creed. A plant's first safety organization must do a lot of pioneering, must blaze new trails, in order that those that come after will have easier traveling.

I believe that the safety movement in many plants has not made the progress that it should because the "method" end of safety has been emphasized and the human end minimized.

Too often, organized safety work has been initiated in plants by the creation of an organization based on a selection of individuals for various committees on geographical considerations, so to speak, entirely—that is, men are rather artificially picked to represent various parts of the plant or classes of work. I do not mean to infer that ultimately such a method of selection of safety committee members is not proper, but I do mean to say that it is not the basis for giving the safety idea the best chance at birth and an opportunity for a flourishing babyhood.

Thus, the first essential is to establish the safety idea by an organization that believes thoroughly in it. Too often extraordinary results are expected in too short a time, and the lack of them leads to a straining in the way of organization. I have known of plants with scores of committees accomplishing less than other plants with one or two. In safety organization as in everything else, quality counts more than quantity. Let the plant safety man take it easy at the beginning, make quality his aim, and his progress in the long run will be greater.

THE MANAGEMENT MUST BE CONVINCED

Assuming that a good start has been made along the above lines, it is in order to discuss other essentials and to refer in further detail to various points in connection with the development and maintenance of good safety organizations.

The next essential is that the plant management have a proper sense of the importance of the subject, and that they make this known to the men in no uncertain way. It is only natural for men to want to do what their superiors are interested in and it is argument of no small weight if the safety man can say to safety committees and the workmen generally "Mr. So and So, our general manager, or superintendent, is vitally interested in our safety work, and nothing will please him more than that we should make a splendid record." It is an encouraging sign of the times, too, that management everywhere now is looking upon safety work not as a paternal fad, but rather as a work of practical and vital consequence to business. In the earlier days of industrial safety, it was sometimes necessary to convince management that safety was a good dollars and cents proposition, but happily now management feels it is

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an important factor in that feature of industrial life that has come to the fore so prominently in late years, viz., the field of human or industrial relations.

KEEPING THE SUBJECT OF SAFETY FRESH AND INTERESTING

And now comes the matter of shop safety organizations and a discussion of means to keep the work of safety fresh and interesting. I use the terms "fresh and interesting" advisedly. To those who have studied safety work in many organizations, the conclusion has come only too often that a lack of success is due to the fact that safety efforts, instead of being fresh and interesting have been stale and dry. The ever-present problem of the safety man is to keep his subject from getting stale. To that end, he must study constantly to keep up interest in safety, and it is upon this fundamental idea that he must build his committees and his safety program generally. I do not think there is any one so-called royal road to success in safety work.

The number of committees and the number of men on same must depend on the plant. No two plants are alike, relatively speaking, as to character of output, location, number, class and type of workmen, and other features.

In the simplest analysis, safety work may be divided into two principal classes:

1. Making the machine as safe as possible by mechanical safeguarding, and
2. Making the workman as safe as possible by training and education.

In regard to the first division, viz., the safeguarding of machinery, little needs be said in this discussion. It goes without saying that all dangerous conditions that can be eliminated or minimized by the application of safety appliances should be corrected.

The safety organization in almost any plant, after its earliest days, will be concerned mainly with the second division, viz., the education of the workman along safety lines. It has been estimated, as the experience of many plants long after the safeguarding of machines with appliances has been carried almost as far as practicable, that upwards of 90 per cent of all accidents are preventable only through the workmen themselves. This brings us to the real problem before safety organizations everywhere—the necessity of workmen being taught to be careful and to develop only safe methods of doing their daily tasks. In the language of the day, safety must be "sold" to workmen. Hence, our conclusion that it must be kept fresh and interesting. The practical problem before us, therefore, takes the form of requiring our safety organization to be able to make the subject of safety a live one always. To that end, the safety engineer of the plant must know his goods and his buyers. He should have those qualities that are necessary in his calling, good personality, a kindly sympathy with humanity, and ability to organize, to advertise—in a word, to deliver the goods.

The safety committees themselves should be carefully selected, and of great importance, I find, is that dignity be established by the plant man-

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agement in connection with their appointment. A letter signed by the superintendent and calling an appointee's attention to the importance of the work of the committee to which he is appointed, gives an important standing to the work in the estimation of the employee so appointed.

I believe safety committees should be frequently changed by having a certain number of the members of longest service drop out at periods of three or six months, their place to be taken by new men. Thus, the continuity of the committee's work is never broken.

The sending of safety committees to visit other plants is another way of keeping the subject alive, and such visits almost invariably result in a committee getting some new viewpoints. I think, too, the practice of getting men outside the plant organization to meet and talk with the safety committees is an excellent thing. In my own organization this feature of our safety work has been especially fruitful.

SAFETY RALLIES WITH ENTERTAINMENT FEATURES AID IN INTERESTING MEN IN SAFETY

Another plan which has stimulated our safety organization has been the giving of evening safety socials in the company's recreation hall. In turn, each of the larger departments of our works has conducted an affair of this kind with much success. The department safety committee arranged, with the assistance of the safety engineer, all details of their own entertainment which consisted of two or three good talks on safety interspersed with music, singing, vaudeville acts, etc. The workmen were allowed to bring their wives and children to these socials and thus the importance of safety was featured to their families. Incidentally, these socials gave the plant management, through the presence and talks of the officials, an opportunity of showing the men that the company's interest in safety matters was being maintained.

In an advertising way, so called, the safety organization should constantly place before the men information and statistics concerning the shop's record. The methods of doing this are many, safety exhibits, photographs, bulletins, clocks, charts, etc.

And now a final word of advice and caution. A plant safety organization should always have clearly in mind the foreman. The foreman should be considered in the membership of the committees themselves, and should get most of the credit of commendable safety performances. In the speaker's opinion, the foreman simply must be "sold" if the best results are to be obtained. He is the man who is with the workman all day long, and if his mind and eye are trained for safety he will detect unsafe and careless methods on the part of his men on their first appearance. He will stamp out danger before it gets a hold. When we succeed in getting our foremen thoroughly imbued with a safety consciousness, we will have made a gigantic stride in solving the present phase of the industrial safety problem. Any lack of results to date must be attributed in large measure, to the fact that on safety our foremen are still "at large." We must see to it that they are put "in captivity" as soon as possible.

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DISCUSSION

CHAIRMAN KERSHAW: I am very glad that Mr. Tinsley placed so much emphasis on the question of educating the plant man. We have got to guard our plants and improve the conditions, so that they will be safe places to work in. But we have got to figure on a broader work when it comes to training workmen.

MR. D. P. KENNEDY (Pittsburgh Plate Glass Company, Pittsburgh): Are recommendations usually turned over to the foreman concerned, with the request that he have the recommendations complied with, or is it more often the practice to turn them over to a committee or a department which takes care of all the safeguarding?

CHAIRMAN KERSHAW: One of our most successful committees is in the laboratory. They go into the buildings and they make an inspection, then come back and submit their recommendations to the director of the laboratory. He goes over the recommendations made and if he approves of them he immediately has a work order issued, and the work is done along with the other routine work, unless it is of extreme importance. In case he doesn't approve, he explains to the committee. To me that is one of the fundamentally correct methods of getting safety recommendations put across.

MR. LASH (U. S. Rubber Company): But how do you get these recommendations through? The manager is interested in keeping his overhead down. Unless you sell the manager, you have a check on safety that makes it almost impossible to carry out any of these recommendations that are constantly being made.

Furthermore, recommendations for safety work are not only being made by your plant officials, by the workmen in your plant, by those who have been injured, but also by the state inspectors.

We have found that this is what happens: If a foreman in a machine shop or master mechanic is asked to do certain things for safeguarding, he says, "All right." He then planks them on his desk along with a pile of orders about three times as high from the superintendent in regard to production work, etc. He says "All right," and that is all that is usually done.

We found it necessary to establish a separate foreman and a separate little shop to do this safety work. When that was done, we made progress.

SYSTEM OF GRADING RECOMMENDATIONS ACCORDING TO IMPORTANCE

CHAIRMAN KERSHAW: I have found that this helps quite a bit: Take all of the state and insurance recommendations and those made by the safety committees and others, bring them all together in one card file, number them all, and then take them up with the safety committee and grade them according to their importance—anywhere from 50 to 100 per cent importance—a 100 per cent item being one which requires immediate attention. Then the plant management can go over them and approve the 100 per cent items first, or disapprove them as he sees fit, and then

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the management simply works down the line and gets the least important items later.

MR. KENNEDY: With regard to overhead cost, we had this plan: At the beginning of each year we secured from the board of directors an appropriation to cover the expenditures for safety during the coming year. That money was set aside and each plant was allotted a share. We were permitted to charge up against safety any important work until we reached the total amount of the appropriation; then we were expected to stop spending money, unless we received further permission.

CHAIRMAN KERSHAW: We will pass on to our next subject, which is to be covered by Mr. Guilbert.

THE FOREMAN—THE DETERMINING FACTOR

HARRY GUILBERT, MANAGER, SAFETY DEPARTMENT, HASKELL AND BARKER CAR COMPANY, MICHIGAN CITY, IND.

The foreman is the determining factor in any safety movement, but he is the determining factor only insofar as the management is interested and in sympathy with it—no farther. If the management has the right attitude toward safety, the foreman will reflect it—or the contrary.

We all know the foreman is a very busy person. He is paid to get production. Nationally production is going to occupy most of his thought unless he knows that the management postively holds him responsible for the safety of his men, just as he is held accountable for the cleanliness of his department, fire protection, the comfort of his workers, etc.

Some foremen are interested in safety for safety's sake and others feel that they cannot be good production men if they give much attention to safety. This does not hold good, as it has been my experience that first rate production men generally have a good record in connection with the other activities of their departments, regardless of whether it is safety or something else. Would you call a foreman a good production man if he produced fifty freight cars in a day and killed or maimed a man in doing so. It is obvious that the compensation paid would cut in on the profits.

WITHOUT FOREMAN'S CO-OPERATION RESULTS IN SAFETY CANNOT BE OBTAINED

The foreman has been well called "the non-commissioned officer of industry" and there is something wrong with the administration of his department if accidents are numerous, for the simple reason he is more familiar with conditions there than anyone else. The army would be useless without its non-commissioned officers, who are its back-bone, and so would modern industry without its foremen. They pass on to the workmen the policy of the management, enforce the rules, and the men understand the foremen are the immediate representatives of the management. Therefore, there is no question whatever in my mind that the foremen are the real safety educators. The safety man can suggest

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to the foreman, can aid him, but without his co-operation results cannot be obtained. If, to begin with, you have the management on your side and you can win the co-operation and enthusiasm of the foremen, the safety problem is solved.

A foreman's duties in maintaining the safety of his department are as follows:

He must make his department as safe as possible by eliminating dangerous conditions, such as poor flooring, improper methods of handling material, defective tools, etc. He must study his department to make it safe as possible. At this juncture he needs the encouragement of the management, who must authorize the necessary changes and safeguards.

Without nagging he should continually keep safety before his men, firmly cautioning and insisting that they wear goggles, not to wear loose clothing, flowing neckties, shoes with thin soles (where nails could penetrate) and so on.

THE MANAGEMENT MUST BACK FOREMEN IN SAFETY DISCIPLINARY MEASURES

He must be firm. If he finds it necessary to discipline or discharge a man the management must back him. Take a case in point: In a department where the work was dangerous to the eye, there was a fixed rule that the men working there must wear goggles. The foreman knew, however, that men were hard to get at the time and beyond telling them that they ought to wear their goggles, failed to discipline them when they did not, because he thought the management would not stand behind him. A workman lost his eye because he wilfully neglected to wear his goggles. In spite of the fact that the company had expended $12,000 in the purchase of goggles, the man was awarded compensation because we could not prove that anyone had ever been discharged or disciplined in that particular for failure to wear the eye protection required.

Foremen do not always take kindly to safety work, because most of them are harassed by the cares of their jobs and it may seem to some that any additional responsibility of this sort is burdensome. I believe it is because the matter really has never been brought home to them. If I were a foreman who had gone out of my way for a year or so to see that the hazards of the work in my department had been reduced to the minimum, and at the end of the year knew that my efforts had resulted in the saving of perhaps a leg, an arm, an eye, or possibly a life, I would have a strong feeling of satisfaction. If on the other hand I knew that I had failed to make the effort that would have saved some poor devil for his wife and family, I would feel miserable. You see it pays in personal satisfaction and saves wear and tear on conscience.

Foremen should not lose sight of the fact that safety work is not a hindrance to production. Very much to the contrary; it is an adjunct. If an experienced man is hurt and loses time from work, possibly he would have to be replaced by a green man, thus retarding production.

The management must have specific, iron-clad rules in regard to the method of doing certain kinds of hazardous work. They must state specifically where goggles and other protection shall be worn. Then the

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foremen must see that the rules are obeyed even though it be necessary to discipline the men for their infraction. By strictly adhering to this policy, you will sometimes save a workman from injury. It may seem to be quite a nuisance to organize along these lines for safety, but after it has become the habit and a commonplace thing, it pays—pays big dividends. Big dividends to the company in saving of lost time and compensation, but above all, great dividends to humanity in the saving of eyes, limbs, life—efficiency—saving the providers for the women and children. Think it over, gentlemen. This is not sentimental drivel, but proved. established fact. Any of the big concerns that have been properly organized for safety for the past five years, can show it in actual figures. There is nothing experimental about it any more. It is considered to be "good business"—the best kind of economy. All well organized concerns endeavor to eliminate waste. Laying aside the humanitarian viewpoint, let us not waste human efficiency.

It is born in most of us to be somewhat careless—to "take a chance". This is especially the case where we do not realize the full danger of the chance we take. This is where the foreman comes in. He must be the instructor. If a foreman will talk to a new man and caution him as to the danger in connection with his job and how best to avoid it, and then watch the man to see that he does what he has been told, being careful will *become a habit* with that man on that particular job. Don't tell him to "be careful". Tell him what to be careful of.

MANY ACCIDENT PROBLEMS SOLVED THROUGH MEETINGS OF FOREMEN

In order to have a successful safety organization, I believe there should be regular meetings of all the foremen and sub-foremen, presided over by either the superintendent or the safety director. We have these meetings each Tuesday in our plant, and have found them to be invaluable. Suggestions are made, ideas compared, torn apart and reconstructed. The combined thought of all is brought to bear on our safety problems. It is surprising at times how quickly and thoroughly a puzzler is disposed of with the experience of all present to draw upon. These meetings promote co-ordinated action.

We hold a monthly meeting, in our "safety hall". By means of motion pictures, the stereoptican, the phonograph, used in connection with our lectures, facts, figures and suggestions are brought before the minds of our foremen and group leaders, interspersed with good entertainment, cigars and lunch. These meetings induce good fellowship. We try to introduce something novel at each of them—always presenting some new thought, using different methods to keep the subject fresh. This is necessary to keep up proper enthusiasm. Even though a foreman may be lukewarm on the matter of safety, he knows he will have an enjoyable evening and is bound to carry away some of the spirit of the meeting and some new ideas, whether he is conscious of it, or not.

The foreman can help by immediately reporting all unsafe conditions to the management. The management can assist by at once adjusting them or calling in the foreman and explaining to him why it is not

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considered practicable to do so, perhaps appropriations for the year are insufficient, and the foreman will feel better if this is explained to him. The same applies as between the foreman and the men under him. After an active campaign of safety education, several suggestions will generally be received from employees. These should be taken into consideration. A good one should be carried out, if possible, or if found to be impracticable it should be so explained to its originator, who should be made to feel that his effort was appreciated. Allowing suggestions to drag along for a time without carrying them out, and without explanation to foremen or workmen, has a ruinous effect on the safety spirit in the shop, and undoes much of the work of the safety man in developing the right attitude.

Proper organization for safety has been reduced to its simplest terms by Mr. W. E. Worth of the International Harvester Company, as follows:

1. A sincere desire on the part of the management to reduce accidents.
2. A willingness by the management to intelligently spend sufficient money to achieve results.
3. A realization by the management that constant intelligent effort is necessary.
4. A man supervising the work who truly believes that safer operation is possible.
5. An organized group of superintendents, foremen and workmen all working to a common end.
6. A definite policy and procedure adopted by management and men, and that policy and procedure adhered to.

In fact, gentlemen, organizing for safety is like organizing of anything else. First must come the wish—then the planning—and then execution.

DISCUSSION

Mr. Stremmel: This question of foremanship is a most vital one, and we are coming to realize that we have neglected the most important factor in industry—the foreman.

In days past we have trained men for salesmanship; we would call our men in from the road once or twice a year; we would have lectures and dinners; we would require them to go through a certain course in order that they might be qualified to sell goods. Today we are beginning to realize that we must pursue the same method in the training of the key man in industry—the foreman.

Why? Because due to the growth of industry, he is the personal representative of the management, he holds a very responsibile position, and because of that fact he must be trained. The old type of foreman is gone; the new type of foreman is here. He must be developed; and in the developing of that foreman, safety plays a vital part. No foreman can be a success as a leader of men and leave safety out of his program, for this reason: safety and efficiency go together.

Chairman Kershaw: The next speaker is Mr. Regula.

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HOW TO PROMOTE SAFETY EDUCATION IN A PLANT

A. S. Regula, District Chief Engineer, Liberty Mutual Insurance Company, New York City

The place to start and the time to start our safety education is with our new man, and yet it is rather surprising to note, as I go around to many plants where presumably the employer has been conducting an intensive campaign of accident prevention, that little or no regard whatever is given to the importance of training the new man.

It is a question as to who is responsible for the education of the new man. We have two types of plants to consider; first, the large plant where there is a well-organized employment department and a well organized safety department, and, second, the plant in which safety, while it forms part and parcel of the everyday operating considerations, is not considered in an intensive way.

Where you have a safety department and an employment department, the problem of the education of the new man has been worked out to a great degree. The applicant for a position approaches the employment office and invariably he is faced with a sign that reads something as follows: "To men who are seeking employment. Unless you are willing to be careful in your everyday work, do not ask for employment. We do not want careless men in our employ."

They get the psychological effect of that. Even before the applicant has been interviewed an effort is made to drive home a safety lesson. He is then interviewed, and perhaps accepted. He passes on to the safety department, and in so many of our larger plants the procedure from that point is somewhat as follows: the employee reports to the safety department, and an effort is made through a lecture by one of the members of that department to acquaint him with the general policies of the company, not alone from the safety standpoint, but the operating as well, and point out to him exactly what measures are taken for his safety in that plant. They tell him something of the organization of the company, of its growth and development and its present standing in the industrial field. They tell him something of the operating conditions of his department, point out to him perhaps through moving pictures or stereopticon views a general layout of the plant and the location of the plant with respect to certain operating zones. They point out to him the importance of safety right from the entrance to his particular manufacturing department or operating zone. They tell him something of the general hazards of the plant.

After that introduction he is conducted personally by a member of the department to the particular operating zone in the department in which he is to be employed. The introduction to the foreman then follows, and it is a real man to man introduction. He is taken in person to the foreman and he is introduced in the proper way: "Bill Jones, this is John Smith, the man that you asked for to fill a position of bench hand. Smith, this is Jones, your new foreman." They shake hands and get acquainted and there is a feeling on the part of the new man that

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there is more than just the industrial situation here, that there is a plant with a soul, that each of the men that he has so far met has gone out of his way to make him feel at home and has pointed out some of the conditions that he is likely to meet in his everyday work. You can immediately count on the full co-operation of that new man in whatever program of accident prevention you may work out.

That method of procedure is of course well adapted to a large plant, but in the case of a small one the problem is somewhat different. I would, however, lay down this fundamental principle—that it is absolutely essential for the foreman, for each of the several foremen, to assume unto themselves the education of the new employee in a positive way. I say positive in contradistinction to the negative form of instruction that forms so much a part and parcel of our efforts toward educating not alone the new man but most of our employees, this idea of being careful and always being careful and all that sort of thing, rather than a specific indication of what the particular hazard is that you are directing your attention to.

BULLETIN BOARD MUST BE ATTRACTIVE AND PROPERLY LOCATED

After the education of the new man, next in importance are the safety bulletin boards. In this phase of safety education we can draw a very distinct parallel between the methods that are adopted by the scientific advertiser and our wide-awake safety engineer. If you are connected with an industrial concern that is about to launch a sales campaign, you will know that advertising forms the basis of that campaign. Your advertiser considers the best medium for his advertisement, he considers the location of the advertisement, in that medium and he considers the wording of this advertisement, so that the readers will not forget the direct action that the advertiser is looking for.

In safety work that is paralleled by the bulletin board, the location of the bulletin board, and the safety bulletin itself by which you are trying to sell the safety idea. With respect to the first of those features—the bulletin board—I am sure that most of you can recall plants with the old type of bulletin board, sometimes not a board at all but rather an attempt to post bulletins on the doors of lockers and cabinets through the plant and oftentimes on a dirty, greasy wall; someone sticks a few bulletins on the wall and then expects that the employee will be attracted to that unsightly place in order to read a bulletin attempting to teach a safety idea.

I think that the best type of bulletin board is one constructed either of wood or sheet metal about 22 gauge, the size depending upon the number of bulletins to be displayed, but with four as the maximum, which would make your bulletin board about twenty-four by thirty inches. That sort of board will accommodate four of the standard bulletins of the National Safety Council or one of its large bulletins. The board should be about four inches deep, which will just about accommodate the object bulletins that are prepared from time to time. The board should have a glass front, should be water-proof, dust-proof, and

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should have a lighting unit at the top, so as to attract the employee's attention.

I suggest also that the back of the board be made removable; have a sheet of beaver board set in snugly. Then the problem of changing your bulletins periodically becomes a simple one; you advance them progressively. One bulletin is prepared once a week. That is for the first of your bulletin boards. Then the bulletins that appear in the first of your bulletin board are transferred to the second one, and from the second to the third and so on.

As to the location of the bulletin board, it is rather difficult to dictate any hard and fast rule, but the board should be placed in such location that the employee will pass it in his everyday work. Oftentimes boards are placed in rather inaccessible places. The employee has to go out of his way in order to get to the bulletin, and naturally the direct effect that you are expecting, that they will have a periodical or constant view of the bulletins that are being displayed is lost.

USE OF ADVERTISING PSYCHOLOGY IN PREPARING LOCAL PLANT BULLETINS

The bulletins of the National Safety Council should of course form the basis of your educational work through bulletins. These must be supplemented by bulletins of your own make, bulletins that have local color. In preparing those bulletins there are a few fundamental principles that are observed by the advertiser and that might be well for you to consider: that an advertisement becomes more effective by reason of repetition, intensity, association, and ingenuity.

Let us see just how these principles work out. The first is repetition. It is hardly necessary to comment on that principle. We recognize, of course, that as things are constantly repeated, sooner or later the employees will absorb that certain safety principle that you are trying to drive through.

The principle of intensity involves the impression that a particular bulletin may make. There has been some discussion in several meetings of the council as to whether gruesome bulletins should be used. There has been a difference of opinion, amounting to objection to such bulletins on the part of several members of the council. There is no getting away from the fact that gruesome bulletins do make an intense impression. Those of you who recall the one showing the blood poisoned hand prepared in all its natural colors with the drip and drain in the arm, the screwed-up, tied-up fingers, issued by the National Safety Council, will remember the intense impression that that bulletin made on each one of you. And I am sure that if anyone had the problem of infection in his plant to deal with, the posting of a bulletin of that nature would be certain to make a distinct impression on your employees, such that they would report to the first-aid room any minor cut or scratch.

The principle of association is of course one that you are adopting all the time. The National Safety Council in the preparation of all of its bulletins realizes this and depends almost exclusively on that principle. A certain unsafe practice in one plant occurs also in other plants.

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Somewhere it results in an accident or near accident. Those who make photographs of such things and send them to the Council help other plants to eliminate the same unsafe practices and accidents resulting from them.

The principle of ingenuity has also been worked out to quite a degree. I have in mind several typical examples illustrating that principle. At one of the plants of the du Pont Company several years ago, I noticed that in their accident prevention campaigning they had adopted as a means of competition between several parts of a large rooster, and the department that went a certain period with the best accident record was privileged to post this large rooster at the entrance to their particular department. Across the top of that were the words, "No Accidents—Something to Crow About." Now that was ingenious. We all like to crow, brag about a certain record that may have been established in the department in which we are employed.

Another device for keeping the accident record is in the form of a clock. This clock is placed at the entrance of the plant. The clock has movable hands and the record of the month and the year appears on the face of it. As lost time accidents occur, the hands of the clock are advanced.

Safety rallies with motion pictures have gone a long way toward securing the interest and co-operation of employees. In any program or safety rally, it is absolutely essential to secure the co-operation of the executives of the plant to the extent at least that some one executive of your company will attend that safety rally and participate in it by making an address telling of the attitude of the management toward the safety program. The employees then become convinced that the safety program is something that is being backed up by the management of the plant, that the full co-operation and interest of the employees is expected.

MORE SAFETY MOVIES NEEDED

Visual education through moving pictures is a direct method of appeal that has not been carried through to its full possibilities. Fortunately, however, the National Safety Council, through its Motion Picture Committee, is giving more and more consideration to this matter of motion pictures, so that before long we hope more safety films will be available to you.

We should bear in mind that you can't constantly drive, drive this safety idea for a full evening; you have got to provide some form of diversion and entertainment—music, and perhaps a comic feature or two will go a long way towards maintaining the interest of the employees, so that when you make your final punch to put across the safety idea the employees will be in a receptive mood.

Other features have been used in several plants, including rule books and pay envelope inserts. The rule book affords a real medium for the education of your employees. However, there is a right and wrong way of preparing a book of safety rules. Invariably in the past, and unfortunately so, the rule book has been a front office proposition; the execu-

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tives represented by the superintendents have gotten together and formulated certain safety rules, depending upon certain unsafe practices or conditions that they may have noted in the plant. The safety rule book is distributed to the employees, and the foreman is compelled, by reason of the fact that it is issued under the sanction of the executives of the plant, to enforce certain rules and regulations of which he had before no knowledge of whatsoever.

If on the other hand the foremen themselves are consulted ,if they are drawn into committee meetings and help prepare this safety rule book, then when it is distributed you are certain hat the foremen will be directly behind it and will do everything within their power to enforce it.

Pay envelope inserts also form a valuable part of the program. However, rather than using inserts it is far more advisable to print your safety suggestions or slogans on the outside of the envelope itelf. It invariably is taken home and you have the opportunity of educating not only the employee himself, but the children.

One other feature that I want to speak of, is the value of the safety calendars of the National Safety Council in this work of safety education. The calendar of 1921 attacks this safety problem perhaps from a different viewpoint than has ever been done before. Each of the monthly illustrations is amusing, and yet carries a very definite safety lesson and attempts to correct some fundamentally unsafe practice that is prevalent in many of our plants. The practice that has been adopted by many plants of distributing the National Safety Council calendar to their employees at the first of the year, so that they have the safety idea in their homes throughout the year, has, I am sure, brought good results in the educational work of these plants.

DISCUSSION

MR. G. S. BOHLIN (Cheney Brothers, South Manchester, Conn.): On the question of gruesome bulletins, I have a story which is just to the point. a cartoon was issued in one of the papers some months ago; it was a picture of a child being carried off the street. A friend of mine told me that he thought a bulletin of that kind should never be published, it was too horrible—but it touched him, it made him think.

MR. REGULA: Mr. Bohlin has raised one point, and I believe I ought to answer in self-defense. I do not advocate, and I don't believe any safety men will advocate, the promiscuous use of a gruesome bulletin that will indicate the result of a particular unsafe practice in all of its details, for example, infection; but if the only way that we can correct that practice is by occasionally posting a gruesome bulletin that will show the blood poisoned arm or the blood poisoned leg, I say, let's post the bulletin.

ADJOURNMENT.

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Automotive Section

September 27, 28 and 30, 1921

ROBERT A. SHAW, Chairman
Director of Safety, Ford Motor Company, Detroit, Mich.

AUGUST L. KAEMS, Vice-Chairman
Safety Engineer, The Simmons Company, Kenosha, Wis.

R. F. THALNER, Secretary
Safety Engineer, Buick Motor Company, Flint, Mich.

TUESDAY MORNING SESSION

CHAIRMAN SHAW called the meeting to order and appointed Mr. George H. Hawes, Safety Engineer, Michigan Mutual Liability Company, Detroit, secretary pro tem. After introductory remarks by Chairman Shaw and Vice-Chairman Kaems, Chairman Shaw appointed the following men as members of the nominating committee: Mr. W. A. Carson, Safety Director, Dodge Brothers, Detroit; Mr. W. E. Beach, Safety Engineer, General Casualty and Surety Company, Detroit, and Mr. W. Dean Keefer, Safety Engineer, National Safety Council, Chicago.

THE FUNDAMENTAL PRINCIPLES OF SAFEGUARDING

JOHN A. DICKINSON, MECHANICAL ENGINEER, UNITED STATES BUREAU OF STANDARDS, WASHINGTON, D. C.

Progress demands improvement:—the instant we stop climbing we start backward. Real progress depends on working steadily forward, improving, building up, and bettering little by little as we go but always with an ideal as our ultimate goal. The safety movement has been started on the right track. If anyone doubts this statement it is only necessary to compare the types of guards used and advocated by safety engineers, insurance carriers, and state departments a decade or even six years ago with those of today. The standards of those days were far below those of today. The art of safeguarding is making rapid progress; that fact is self-evident. But what of the future? Toward what ultimate goal are we heading? With many safety engineers the future is left to take care of itself. The ideal is lost sight of in the daily routine of guarding. In

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order that we may have a definite objective, let us consider the factors that must be considered in drawing up the specifications of an ideal guard.

THE IDEAL GUARD

Because it is primarily a device to prevent injury, the first consideration must be the protection afforded by the guard. This first fundamental then is easily stated—the ideal guard must give the *maximum of protection.* In many cases it is not too much to ask that it give 100 per cent protection.

The second point to be considered is what is its effect on production? The function of a machine is to do work—to produce something. If the guard in any way interferes with this primary function of the machine it is evident that the guard will fall below the requirements of an ideal. We might even go further and say that a guard ought to speed up production, either by eliminating that constant although perhaps subconscious fear on the part of the operator, thus allowing him to devote his entire attention to the work in hand, or by allowing him to assume a better or an easier position at the machine. Our ideal guard then must certainly not interfere with production, but should on the contrary actually increase the output of a machine.

No machine built can be run indefinitely without attention. Thus, the third requirement of our guard is that it shall permit of easy and quick adjustments and replacements on the machine. This is the rock on which more than one safety ship has gone down. Perhaps it would be well to emphasize this particular attribute of our ideal—*accessibility.* The safety engineers who always consider that factor in the design of a guard need not fear much opposition from the various production departments or the mechanical force.

Our next consideration must take into account three enemies known to every plant, wear, tear, and depreciation. These three arch enemies have a standing challenge against anything that is man-made, be it the Pyramid of Ghizeh or a shop tool. Their song, like that of the Undertaker's Wagon in Kipling's poem, is "We'll get you in the end."

If a guard is poorly built—well they surely can make a meal of it in record time. How many pretty guards have ended on the scrap pile after a few months or years! Let us put down then for our fourth requirement, *ruggedness.*

Haven't you seen guards that looked as though no brain short of an Edison or a Steinmetz could have conceived them? One of those intricate outfits that made you dizzy to look at? And how often might these guards be simplified or separated into several simple guards! If a guard is to qualify as an ideal it must be as simple as it is possible to make it and still meet the other requirements.

This idea of simplicity naturally brings up the point of the skill necessary to build it. Obviously it should be easily built by the mechanics available and on machines already in the plant. Likewise it is equally obvious that it should be built of materials easily available, and best suited to the plant in which it is installed.

A manufacturing plant is intended primarily to make goods which are

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to be sold at a profit. The cost of labor and raw material together with a thousand and one other items which go to make up the "overhead" must be deducted from the sale price before a profit can be shown. The cost of guards must, of course, be taken into account in computing manufacturing costs, consequently if a plant is interested in keeping down these items of "overhead" (and where is the plant that, particularly at the present time, is not interested?) the cost of guards should be kept as low as possible. In other words the ideal guard should be of the cheapest form of construction consistent with strength and serviceability. This factor of course involves the question of simplicity, materials, and available labor which have been included in other desirable features of an ideal guard. It does, however, bring up another consideration—the question of standardization; it is much cheaper to build twenty belt guards that are identical than it is to build twenty different guards. In endeavoring to install guards as cheaply as possible, guards should, wherever it can be done to advantage, be placed in standardized groups which can be manufactured on a quantity basis.

To sum up the desirable attributes of our ideal guard we find that it must:—

1. give maximum protection
2. not interfere with production, but rather speed up production
3. give easy access to the machine for repairs or adjustment
4. be rugged enough to stand large amounts of wear and tear, even abuse
5. Be simple in design and construction
6. Be easily built by labor on the plant without the use of special machinery
7. Be made of material easily available and best suited to the industry
8. Be of the cheapest form of construction consistent with strength and serviceability.

MAXIMUM PROTECTION

Taking the first requirement—how shall we obtain the maximum protection? Evidently by totally enclosing the hazard; a screen placed on one side of a train of gears will doubtless give some protection but will still leave the possibility of contact at the ends or over the top. A guard must be high enough to eliminate the danger of accidental contact. The exact height to which a belt should be guarded is a much mooted question; generally speaking the insurance and state standards will give ample protection. The main point is *complete inclosure.* Many accidents are due to men reaching behind guards which do not fully inclose a hazard. The size of mesh used for filling in must be such that there is no possibility of fingers being inserted in the mesh openings far enough to be caught by any moving part of the machine.

RELATION TO PRODUCTION

When designing a guard the question of interfering with the operation of the machine is a vital one. The guard must be so located as to allow the operator to stand in his normal operating position or in a position

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even more favorable. The safety engineer who is blessed with the power to see in his mind's eye the completed guard before it is built has an enormous advantage in the design of structures of this kind. For the engineer not so gifted the outline of the guard may be chalked on the floor, and the relative position of the operator and the guard may then be studied in detail.

Point of operation guards should be studied out carefully with particman Shaw, Vice-Chairman Kaems, and Mr. Hawes as chairman of the statistical committee, Chairman Shaw appointed the following men as members of the nominating commitee: Mr. W. A. Carson, Safety Director, Dodge Brothers, Detroit; Mr. W. E. Beach, Safety Engineer, General Casular reference to the cycle of operations. A guard that adds any unusual or laborious movements is bound to be unpopular with the operator, no matter how safe it makes the machine. When proper consideration is given to these points of operation guards it is frequently possible to actually increase production. Thus the substitution of dial or chute feeds for the hand feeding of power punch presses will generally not only eliminate a serious source of accidents but will also speed up the operation considerably. A joint conference of the safety engineer, production engineer or plant master mechanics, and the foreman of a department in which serious accidents are occurring will frequently result in improved devices or methods of operating that will not only eliminate accidents but aid production as well.

ACCESSIBILITY

To build a guard that will give access to the machine sounds simple. Unfortunately the work of actually installing the guard is frequently left to plant mechanics who sometimes fail to realize the need of easy access to the machine. Ofttimes a rigid guard is put around a machine with the result that the first time a repair is to be made the guard is torn apart and frequently ends up on the scrap heap. It is but seldom that such guards are replaced although thousands of them are built and installed.

A guard that has hinged panels or is so mounted that the entire guard may be swung back is built almost as easily as a solid guard and possesses the advantage that when repairs or adjustments are necessary it may be quickly opened and as quickly replaced when the work is completed.

Guards fastened to floor plates with special catches or set in floor sockets are, of course, better than those rigidly fastened, but are sometimes removed and not returned when the work is complete.

A safety engineer should personally see or arrange to have his inspectors look over each new guard before it is installed to make sure that with the guards in place the parts of the machine which may need attention are still accessible. Proper openings for lubrication are also important and should be given due consideration particularly in the case of solid inclosures for gears and sprockets.

RUGGEDNESS

The question of ruggedness is one that in the past has received entirely too little attention. The standard specifications given in insurance hand-

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books or state laws are the minimum requirements and guards so built will often prove to be entirely too light when subjected to the impact of hand or power trucks, to the impact from heavy materials, or to other severe treatment. Thus a standard hand rail installed in a location such as a lumber yard where it is used as a rest for heavy material will not give more than a few months' service, whereas the same rail placed on an oiler's runway would probably be in good condition ten years from the date of installation.

As a general rule guards built by the manufacturer of a machine will give longer service than those put on after the machine is in use. The reasons for this are two-fold—first, because they ordinarily occupy less space than the guard fabricated at the plant, consequently are not struck by moving objects at such frequent intervals, and second, because they are generally more substantially built and of heavier materials than are commonly used in guards fabricated on the job. The factory built guard is almost without exception designed to give the maximum accessibility to the machine. It is a safe rule to build a guard too heavy rather than too light. This applies particularly to guards of sheet metal, mesh, or expanded metal. Consider the service to which a guard will be subjected and then build it twice as strong as seems necessary if you want a guard that will have the maximum life and give the best service.

SIMPLICITY

A guard to be simple should have the minimum number of angles and bends. Highly complicated guards are expensive to build, are more subject to accidental injury (largely because of the difficulty of adequately bracing the frame work and filler), and as a rule do not provide the accessibility that smaller and more simple guards provide.

AVAILABLE LABOR AND MACHINERY

Guards fabricated on the plant are generally built by repair mechanics, handy men, or such other skilled labor as is available. The nature of this labor will to a certain extent determine the type of the guard. A plant which normally employs a number of pipe fitters but relatively few machinists (such for example as a chemical plant) naturally would use a guard frame of piping while a sheet metal plant would naturally make as many sheet metal guards as possible, having available the men and machines with which to do work of that kind. It is only in plants where large numbers of guards are to be built that the expense of special machines for their fabrication is warranted. If special equipment is available it may often be advantageous to use it. A spot welder for instance makes an ideal fastening between frame and filler, and if available should be used, but the cost of such equipment is such that if it is to be used exclusively for the fabrication of guards, the expenditure would not be warranted.

MATERIAL

Closely allied with the question of labor and machinery available is that of the material from which guards are to be made. A sheet metal work-

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ing plant such as a ventilator factory would naturally use as many sheet metal guards as possible, and foundries frequently make cast iron guards for gears and sprockets on tumbling barrels. This is only logical; it would be absurd to suppose that a sawmill located twenty miles from a railroad, where supplies must be carried in by truck would bring in angle iron and expanded metal when there was lumber of any desired size or thickness piled in the yard.

In certain industries guards of metal would introduce new hazards. Plants manufacturing explosives and dye stuffs, and those using flammable solvents must of necessity turn to guards of wood or fibre.

COST

The cost of guards in the average plant is considerable; quite naturally the tendency is to make a guard as cheaply as possible. This, provided the guard is strongly built and is effective, is most desirable. A professor whom I once had for a course in business economics had a motto, "Good enough is best." In other words the cheapest installation that will do the work satisfactorily is the best for the purpose. This item of cost is one to which many safety engineers give but little thought. Some of the following points may suggest methods of reducing costs on guards. Make standard guards for all machines of the same type. If you have twenty radial drills of the same pattern make all twenty belt guards at the same time. Do not waste the material by making the guard larger than necessary. If the bottom of the pulley on a machine is three feet above the floor it is obviously a waste of material to run the guard to the floor. In many cases it is cheaper to use a small mesh and place the guard close to the part to be guarded than it is to use larger mesh and locate the guard four or more inches from any moving part. Frequently scrap pipe may be used for guard rails and frames. Care should of course be exercised in picking out pipe that is sound and mechanically strong enough for such purposes.

While this paper has not covered the broader aspect of safety work, the proper design and layout of new buildings and equipment, the same factors that govern the fabrication of guards will apply here. It is in this larger field that the true safety engineer may work to the best advantage and may approach closer and closer to the ideal, a plant where the hazards have been reduced to an irreducible minimum.

DISCUSSION

Mr. Louis H. Simpson (Master Mechanic, Potter Drug and Chemical Company, Malden, Mass.): In the last five years I have spent about $25,000 for various types of guards for gears. Where the gears are inaccessible, I think pipe rails (at least three rails) will keep a body from falling against those gears. Where the gears are accessible, the solid guard is the best. I have used some mesh guards and find them very unsatisfactory. Sixteen or eighteen gauge sheet iron will stand a truck running into it; but if you bump into a mesh guard, it doesn't take much of a bump to damage it.

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MR. DICKINSON: I don't believe you will find many state laws that will permit the mesh guard; I don't think the new national code is going to permit it.

CHAIRMAN SHAW: All pipe used for guards should be kept separate and marked, or some day it may be put up in steam lines.

MR. DICKINSON: That can be taken care of by painting your pipe green.

MR. LYMAN (American Tube Company, Bridgeport, Conn.): Most of our machinery was equipped with pipe guards but many of the fittings were bumped into and fractured In replacing these broken guards, we make guards in two parts, galvanized wire mesh at the top, with a lower panel at least three feet high of heavy steel plate. This plate is fastened to a heavy angle iron that is secured to the floor to prevent its being moved away.

MR. DICKINSON: How heavy is that steel plate on the bottom?

MR. LYMAN: It runs in some cases to $\frac{3}{16}$. We have guard panels that are 35 or 40 feet long, all smooth surface, and the results are very gratifying.

MR. Z. N. LORD (Geeral Electric Company, Lynn, Mass.): We have a delegate with us today—Mr. Henry V. Neal, two years ago the winner of the Anthony Brady Medal for safety devices.

MR. HENRY V. NEAL (Machinist, Boston Elevated): During the past seven or eight years, we have put many guards around the various machines in our shops. Where there is danger of a man stumbling against a belt, a pipe rail would be satisfactory protection. We have a very large machine in our shop that I covered entirely; a "man-slaughtering machine" with an eccentric gear, one of the most dangerous machines made; we encased it with $\frac{1}{16}$ sheet steel, rendering it impossible for anybody to get near it. We covered a boring machine with $\frac{1}{16}$ sheet steel, leaving a door on the side where the operator can get in to make adjustments.

Sometimes I have put wire netting with a piece of sheet steel around some of the smaller gears, on a small lathe, for instance. You can see that the gear is doing its work properly, and being removable, can be easily kept clean. If the guards are eight inches from the floor, they make it easier for the clean-up man.

WHY GRINDING WHEELS BREAK

E. W. DODGE, ASSISTANT TO GENERAL MANAGER, ABRASIVE COMPANY, PHILADELPHIA, PA.

Grinding wheels is a general term used in referring to all kinds of wheels regardless of the abrasives and binding agents used in their manufacture.

Abrasives or abrasive materials are the cutting particles of which the wheels are composed and are of two different types, natural and manufactured. The natural abrasives are known as emery and corundum and are mined. Manufactured abrasives are of two kinds, luminous and carbide of silicon, to which different manufacturers have given registered

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trade names. They are produced with the aid of electric furnaces of different types. All abrasives are crushed and rolled down to different grain sizes, which are separated by means of sieves fitted with wire cloth or grit gauze having different size openings or meshes. Manufactured or artificial abrasives are most generally used.

Grinding wheels in most common use are made by four processes to which reference is made later and any of the abrasives mentioned can be employed in making wheels by any of these processes.

Inasmuch as the processes and binding agents employed in the manufacture of grinding wheels have a more or less direct bearing on some of the causes of breakage, it would seem to be in order to refer to them briefly before attempting to discuss the subject matter of this paper in detail.

A large majority of the grinding wheels now in common use are made by what is termed the "vitrifying process," and are usually referred to as "vitrified wheels." During the process of manufacture they are subjected to a gradually increasing heat up to approximately 2200° to 2400° F. This causes the bond which is composed largely of clays of different kinds to melt or fuse and form a glass or glaze which adheres to the abrasive grains with which it is mixed. When cooled, wheels of this type are of an open, porous structure, their density depending largely on the grain size of the abrasive and volume of bond used. Vitrified wheels do not possess the elements of resiliency or elasticity in the slightest degree, and their strength is proportionate to the grain size and amount of bond used.

Silicate wheels are made by mixing the abrasive grain with silicate of soda in liquid form and certain other materials which do not materially affect their strength, and pressing and tamping to size and shape in moulds after which they are subjected to a heat treatment sufficient to mature and set the bond. There is little if any elasticity in wheels made by this process.

What are termed elastic wheels are made by mixing abrasive grain with flake or ground shellac principally, which when subjected to sufficient heat fuses becomes a plastic mass and is then moulded to form and shape.

Vulcanite or rubber wheels are, as the title implies, bonded with rubber. Both elastic and rubber wheels have a high degree of elasticity, will resist side pressure to a considerable degree and will withstand a much greater centrifugal strain than wheels made by the vitrifying or silicate processes.

It is well to bear in mind that wheels made by all these processes differ in strength, largely dependent on the amount and kinds of bonds used, which in turn is determined by the character of the grinding operation for which the wheels are to be used. However, all have their uses, are well within the factor of safety when properly mounted and used.

Grinding wheels are made in sizes varying from ⅛ to 60 inches in diameter, and from $\frac{1}{64}$ inch to 12 inches and more in thickness. Practically all grinding wheel manufacturers test their wheels 6 inches in diameter and over immediately before shipment at a speed of 9,000 to 10,000 peripheral feet per minute, without application of work, except those which are

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designedly made for some particular purpose and which demand either a higher or lower speed test. This test subjects them to a centrifugal strain three to four times greater than that which they receive when in actual use at recommended speeds. This is done primarily to prevent sending out wheels which may be defective or which may have been injured during the course of manufacture. Such defects and injuries are usually discernible in the regular course of inspection to which all wheels are subjected, but the speed test, as described, makes assurance doubly sure.

There are many reasons why grinding wheels break and most of them are attributable to ignorance and carelessness. The most common causes of breakage are described as follows:

CARELESSNESS IN HANDLING AND STORAGE

Wheels can be dropped and injured in such a manner as to make them unsafe to use, therefore all wheels should be very carefully examined and inspected upon receipt to be sure they have not been injured in transit and especially so before being mounted for use. Thy should be stored in dry places supported on edge in racks provided for that purpose, except thin wheels made by the shellac and rubber bonded processes. In storing thin wheels, say ¼ inch and thinner, made by the elastic and rubber processes, they should be laid flat on a straight surface and to prevent warpage, otherwise, they will run out of true, and breakage may result.

CATCHING OF WORK WHILE BEING GROUND

In many grinding operations, especially when the pieces being ground are held by hand, rests are provided on which the work is supported. If these rests are not constantly adjusted as the grinding wheel is reduced in diameter and thickness the work is liable to be caught and jammed between wheel and rest. The same result will follow if in truing or dressing wheels, the dressing tool is allowed to be caught or jammed.

EXPANSION DUE TO HEAT

During many grinding operations a considerable amount of heat is generated and may cause the arbor or spindle on which the wheel is mounted to expand. When wheels are mounted they should slip on to the arbor easily to allow for expansion of this character. Spindles are also liable to expansion due to heat caused by too tight bearings or inner flange not fixed to spindle.

IMPROPER MOUNTING

The following are some examples of what is termed "improper mounting: "forcing wheels on spindle and screwing them on to taper arbor; mounting wheels without support of flanges and simply screwing a nut up against the wheel, the wheel support consisting of a shoulder on spindle only; the use of flanges too small in diameter to provide proper support; using one flange only and holding the wheel on spindle by means of a nut screwed up against the wheel; using flanges of different diameters causing uneven strain; uneven bearing of flanges due to using bent

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or broken flanges; high spots on flanges or wheels; bushings projecting beyond the sides of the wheels; undue tightening of nut holding flange against side of wheels causing undue strain; mounting wheels without compressible washers between wheel and flanges; washers of too small diameters to provide the proper bearing surface (washers should be slightly larger in diameter than the flanges and should be made of a material sufficiently thick to form a cushion tending to counteract any inequality of surface of both wheels and flanges); mounting wheels on weak and shaky machines; mounting wheels of larger diameter or thickness than machine is designed to support.

In addition to the causes of breakage already cited, which, as stated, are most commonly encountered, grinding wheels are broken through improper use and lack of care, such as continuing to run wheels badly out of true (and usually out of balance as well); using the wrong kind and shape of wheel; revolving the wheels at too high a peripheral or rim speed for any given size or shape, grain, or grade.

In cylindrical grinding there are many parts ground on which there are shoulders or projections. If wheels are unduly forced against these shoulders or projections, breakage will result. It is possible also to break a wheel in operations of this character by overcrowding it against the work in an attempt to take deep cuts, especially if the wheel, to do its work properly, must be what is termed "soft in grade."

We occasionally find operators hacking the face of the wheel with a heavy hammer or some other heavy article with a sharp edge, in an attempt to bring about faster cutting conditions. This is liable to weaken wheels to such an extent that they will break, even if they do not break in the act of hacking.

Wheels are also sometimes broken by a heavy object coming in contact with the side of the wheel when running or standing idle.

Reference was made earlier to the processes and bonding agents employed in the manufacture of wheels as having a bearing on some of the causes of breakage. As an example, a great number of comparatively thin wheels of large diameter are used for cutting off small stock, such as bars of different metals and sizes, tubing, etc.; grinding in slots; sharpening and gumming fine tooth saws; also grinding in throat or grooves in railroad frogs and crossovers. Many if not most of these operations require wheels ⅜ inch thick and thinner, and from 8 inches to 14 inches in diameter. While it is possible to use wheels made by the vitrifying and silicate processes in some instances, the fact that they are absolutely rigid and without elasticity makes them dangerous to use unless extreme care is exercised, because any side strain or buckle will cause them to break. On such operations wheels made by either the elastic or rubber processes should be used as they will withstand more or less side pressure and buckling due to the fact that they possess a certain degree of elasticity and will also withstand a greater centrifugal strain when running at high speeds; these wheels are usually employed especially in cutting off small stock, tubing, etc.

There are some grinding operations which require that a comparatively flat surface be maintained. This class of grinding should not be done on

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the sides of straight or disc wheels, but on cup wheels or cylinder wheels, preferably the latter as they can be mounted in chucks designed to hold the wheels firmly in place and with but a comparatively small portion of the wheel exposed. If such grinding is done on the sides of the ordinary disc wheel it will soon tend to weaken the wheel through wear and although it may have been sufficiently strong in its original thickness, it would be likely to break after it is worn to thinner dimensions.

These examples illustrate what we mean when we refer to using the wrong kind and shape of wheel.

Wheels that are run wet and are left partially submerged over night naturally become badly out of balance, the submerged portion being much heavier than the exposed portion. If such wheels are started up at full speed before becoming fully and evenly impregnated with water or grinding compound they are likely to break on account of the unequal strain exerted.

Grinding wheels can be broken if operated at too high speed. The rates of speed recommended by grinding wheel and grinding machine manufacturers vary from 4,500 to 6,500 peripheral feet per minute, depending on the character of the grinding operation and type and condition of grinding machine used. For example, the cup form of wheel, owing to its shape, is considerably weaker than a straight wheel of the same weight, and in consequence a slower rate of speed, usually 4,500 peripheral feet per minute, is recommended. Straight wheels when mounted on bench, floor, swing frame, and other machines for rough grinding, and when protected with properly designed flanges and hoods, can be run at a somewhat higher speed, say 5,000 to 5,500 peripheral feet per minute. Wheels used for precision grinding, because of the character and design of machines employed in this class of grinding, can be run as high as 6,500 peripheral feet per minute. In some special instances a still higher rate of speed is allowable if mounted and operated under proper conditions. In such instances rubber or shellac bonded wheels are generally used.

It is desirable in most grinding operations to maintain approximately the same peripheral wheel speed as they wear down. This can be accomplished by various methods such as variable speed countershafts and cone pulleys on the spindle of the grinder, also variable speed motors.

When machines are fitted with cone pulleys great care should be exercised in mounting new wheels to be sure that they are not run at the high speed, which will of course happen unless the belt is changed to the low speed step. This is especially important where machines of the bench and floor grinding type are used for rough grinding.

In some shops where grinding of this character is done largely, one man is employed to test and mount wheels and dress them from time to time to keep them in true, and to change the speed as the wheel wears down in diameter or remove it and mount upon another machine operated at the right speed. Whatever plan is adopted, the machine spindle speeds should be tested and determined correct for size of wheel to be operated before the wheel is mounted.

It is obviously impracticable to provide means whereby operators abso-

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lutely cannot mount and revolve wheels at a higher rate of speed than recommended, but in order to prevent this so far as possible, grinding wheel manufacturers recommend speeds at which their grinding wheels should be run; this information is entered on the identification tags accompanying the wheels at the time of shipment.

While breakages may occur for which there is no apparent reason, they can usually be traced directly to some of the causes herein described, provided the full facts in connection with such breakages can be ascertained.

Grinding wheel manufacturers early recognized the necessity of not only providing some protection for the operator, but for the wheel as well, in order to protect it so far as possible against accident. Many devices were designed and put into use, mostly in the form of protection hoods and flanges of different shapes and designs. Nothing was done toward standardization, however, until the Grinding Wheel Manufacturers' Association was formed, when a safety committee was appointed, whose duty it was to fully investigate the causes of wheel breakages and the various protective devices in use, and to present and recommend safe and reasonable rules for the construction of grinding machines and protection devices and the use of grinding wheels. Many tests were conducted and tables compiled, in which the safety committee of the National Machine Tool Builders' Association co-operated. After the results were carefully checked and presented for discussion, they were approved by both associations and were published in pamphlet form, under the title "Safety Code for the Use, Care and Protection of Abrasive Wheels and the Parts of Grinding Machines Related Thereto." This safety code is intended to be used for the help and guidance of national and state legislative bodies, insurance companies, builders of grinding machines, users of grinding wheels, and anyone who may be directly or indirectly interested in the subject of grinding. Copies are being very liberally distributed and can be obtained upon application to any manufacturer of grinding wheels in the United States or Canada.

DISCUSSION

MR. R. H. MURDOCK (Foreman, General Electric Company, Everett, Mass.): Do you recommend certain sizes of flanges for certain sizes of wheels?

MR. DODGE: Yes. Such recommendations are published in almost every grinding wheel catalog; they are also given in this safety code.

MR. RUSSELL (The Norton Company, Worcester, Mass.): The fourth edition of the code which Mr. Dodge mentioned is being prepared under the auspices of the American Engineering Standards Committee. The sponsors for the code are the Grinding Wheel Manufacturers' Association and the National Association of Industrial Accident Boards and Commissioners. The sectional committee which has drawn up the code consists of twenty-five or twenty-six members, representing every organization which is in any way interested in grinding wheel safety. We hope that code will be ready for distribution within six or seven weeks. You may obtain copies from any grinding wheel manufacturer.

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MR. W. W. WILLIAMS (Safety Engineer, Employers Indemnity Corporation, Kansas City, Mo.): Should a flange be half the size of the diameter of the wheel?

MR. DODGE: Grinding wheel manufacturers recommend that flanges should be from one-third to one-half, preferably one-half, the diameter of the wheel.

MR. WILLIAMS: There is usually a tag on the side of the wheel. It is quite thick sometimes, and much smaller than the flange. Why couldn't that be made the proper diameter for the flange?

MR DODGE: Some wheels on which blotters are to be placed are of a shape and character which prevent doing this. We speak of these as compressible washers glued to the sides of the wheel, slightly larger than the flange that is recommended for that size of wheel. In other words, a 16 inch wheel would have a blotter 8¼ inches in diameter on the side.

We have what we term "taper-sized" wheels, on which we recommend that as large flanges as possible be used. Some grinding operations are of such a character that we have to get down on the sides of the wheels; consequently we can't mount these wheels with such large flanges. It is well to use as large a wheel as possible, in that case your compressible washers must be large in proportion.

MR. RALPH M. HENDERSON (Assistant Foreman, Boston Elevated): Is the lead bushing in the emery wheel put there to take care of expansion?

MR. DODGE: We use a soft lead bushing so as to have a certain amount of give. The practice in bushing wheels is to allow about six-thousandths.

MR. H. F. WEBB (Safety Engineer, Liberty Mutual Insurance Company, Boston): What size wheel would you say would be a minimum that would require a guard?

MR. DODGE: Wherever possible every grinding wheel should be guarded. If the wheel is large enough, it is advisable to use a taper type with taper side flanges, but whether this taper arrangement is used or not, it is best to install hood guards also.

Even in an internal operation, wherever it is possible, wheels should be protected in some manner, either by a hood or by flange and chuck.

MR. F. D. WARREN (Safety Engineer, American Mutual Liability Company, Boston): Do you advise that those guards should be of steel and not of cast iron?

MR. DODGE: We recommend steel. You can get the maximum strength within a minimum of space.

CHAIRMAN SHAW: We are reinforcing many of our cast iron guards with steel bands.

MR. WARREN: We frequently find light cast iron guards rusted almost through. This is extremely dangerous—a man is depending upon something which is unsafe.

CHAIRMAN SHAW: I would suggest that the grinding wheel manufacturers seriously consider the efficient guarding of grinding wheels and that they recommend that the guards be made of steel in place of cast iron.

ADJOURNMENT.

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WEDNESDAY MORNING SESSION

Chairman Shaw called the meeting to order. Mr. Pefferly was the first speaker.

ELECTRICAL HAZARDS AND PROPER INSTALLATION OF EQUIPMENT

W. J. Pefferly, District Sales Manager, Square D Company, Detroit, Mich.

From time to time you have seen data on electrical fatalities which on their face looked rather out of proportion, but we are nevertheless free to admit that the electrical hazard is rapidly taking the place of the mechanical hazard, such as gears, belts, etc. Therefore it should be one of the first attacks of the safety engineer.

Why is electricity, when not properly installed and safeguarded, a more dangerous hazard than machinery? The eye and the brain work in harmony. The instant the eye observes an object in motion, such as a gear or a belt, the brain impels the feeling of fear and caution. With electricity, that invisible force, there is no motion; the distributing installation, control apparatus, etc., look so harmless. How can we overcome this motionless hazard? Were it possible for us to inject the fear of electricity into the minds of the people who come into our plants, in such a manner as a child is taught to keep away from fire, and could the same watchful eye be placed over these factory employees as a mother holds over her child, maybe safety precautions would be unnecessary. That, however, is one of those things "that never happen."

Even the turning gears, with their warning sounds claim their proportion of victims, so our only recourse is the proper installation of electrical apparatus, and at that, the best and most practical obtainable.

HIGH TENSION ELECTRICAL CURRENTS

By high tension we refer to circuits of over 600 volts. The hazard of these high voltages is recognized by almost everyone. I say "almost" as there are still a few cases where an electrical man considers these voltages to be harmless. Any man, however, trained or untrained, is apt to slip or lose his balance while working on this equipment; the result is easily conceived.

Although the majority of exposures to this high voltage are among employees of lighting, power, and railway companies, we cannot overlook the fact that we have some similar conditions of our own. The average industrial plant today buys electrical current from central stations, having it carried into the factory as high tension, and then transforms it into low tension voltages, ranging as operative requirements demand.

In the majority of cases, as should be in all cases, we visualize our high tension equipment such as transformers, oil switches, lightning arresters, etc., as being installed in an isolated out-buildng, known to the electrical man as a sub-station or transformer house. Although we provide that

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only thoroughly experienced electrical men have access to this substation, we cannot let this prejudice us against supplying safety precautions; experienced men are not absolutely immune from accident.

I have seen cases where the engineer when designing a transformer house thought too much of a compact and neat layout, forgetting the fact that at one time or another it would be necessary for the men to repair certain apparatus, thus requiring the repairmen to use extreme care to avoid coming in contact with any live parts.

I have also seen cases where this apparatus such as the disconnecting switches, lightning arresters, etc., were left without any screen protection whatever. Our remedy is to allow sufficient room in back of the board as well as in the front, and the entire outfit should be enclosed in heavy wire screening. Heavy rubber matting should be placed over the entire area of the floor within the enclosure. In some plants the transformer house is used as a ware-room for storing old material. This is another condition that should be eliminated in considering safety.

LOW TENSION CURRENTS

Our greatest hazard in the factory is low tension distribution. It is often contended that a voltage is less than 600 is harmless and that it can be taken across the fingers without causing any appreciable damage. This may be true when surrounding objects are perfectly insulated. Should the person in question be standing in a grounded condition, the shock is sufficient to cause death. It is agreed that one-half an ampere passing through the body is sufficient to prove fatal. Should a person come in contact with a live wire or switch accidentally, it is more apt to prove fatal than if the contact were made purposely. As an example—suppose a revolver is discharged in a room and you have been previously warned. The shock is not as noticeable as if you had not been warned. The nervous system is set ready to receive the impulse. If the revolver is discharged without a warning, your heart would miss a beat or two. Now if this bodily effect is produced by a sudden shock or noise, what will be the condition of the body to withstand an electrical current passing through it, after being rendered in a frightened condition?

SWITCHBOARDS

The average designing electrical engineer puts his greatest pride in a highly polished switchboard. He claims that this is one way in which he can show a quality job. I recommend a dead front board, exposing no live parts. Although it does not show the highly polished copper, the fact remains that it is 100 per cent safe. I have built many dead front switchboards with safety switch units. This makes an attractive switchboard and has many advantages not offered on the open board. All wiring is concealed within the switch cabinets and troughs placed on the back of the board. In this way we can save space and still maintain safe working conditions.

Where an open board is already installed, we should make conditions such that accidental exposures will be reduced to a minimum. The open front board should be protected by a stout screen, extending seven

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feet above the floor level. Heavy rubber matting should be placed within the enclosure.

WIRING DISTRIBUTION

In every electrical installation there is always a small amount of leakage, and a slight grounded condition always exists. This is more apt to be the case on open work than in a conduit system, being caused by vibration of the building and gradually breaking down the insulation on the wires at the supporting points. To remedy this, all wires should be placed within a steel casing or conduit and especially so where subject to mechanical injury.

SWITCHES

In some factories I have seen some of the best conduit installations ever brought to my attention. They were jobs of which any electrical man could have been proud. But after going to all this labor and expense of putting in conduit over the entire system, the factory owner installs at each control point a contrivance known as an open-knife switch placed within a service box or steel cabinet. The folly of this installation can readily be seen, as the operator, whenever he desires to start or stop the motor has to reach inside the box and expose himself to the copper switch jaws. Now why place the wire in conduits, at a large expense, when the switch is exposed; the switch is the point that must be operated and is the point of danger? This is an example of "Penny wise and pound foolish" administration.

The installation of safety, exterior-operating switches is a remedy. These switches should be so marked as to indicate whether the switch circuit is closed or open. Provision should be made for locking the box "closed" and also for locking the switch in the "off" position. This latter precaution taken, should repair men be working on the line or on the machine which this switch controls, they can lock the circuit "open" without danger of it being "closed" by any one other than the operator in charge.

SWITCHES AHEAD OF COMPENSATORS ON MOTORS 7½ H. P. OR OVER

It is contended by some electrical men that the compensator or auto starter controlling motors of this size is both a starter and a switch. This contention is all wrong, as the Board of Underwriters specifically states that each motor with its starting device (the compensator being the starting device) shall be controlled by a switch which disconnects all wires and is located within access to the operator. This is a necessary safety precaution, as it gives the operator two points for control. The compensator is a complicated mechanism and is more apt to break down than a simple disconnecting switch. Another feature of an installation of this kind, is that it permits a repairman to work on the compensator with the current off.

FUSE PROTECTION

Too much cannot be said on this subject. You may go into some of the best electrically equipped plants and find that fuses have been "padded" or circuit breakers set far out of adjustment. This is done because the

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particular circuit is grounded or overloaded, and the "padding" is the result of carelessness in not having the real trouble remedied. It may be the work of some machinist to enable him to overload a machine and increase his production. He does not realize that he is damaging the machinery and increasing the possibility of fire by exceeding the current carrying capacity of the electrical wiring.

In one plant that I visited every circuit fuse was replaced by a strip of bare copper wire. When I questioned the superintendent, his reply was that he had had so much trouble with fuses blowing on account of fluctuating voltages that he was forced to "pad" and rely on the primary fuses of the transformer to give him protection. Three weeks later he called me on the 'phone and told me that a safety switch controlling a 100 H.P. three-phase motor had broken down; he emphasized the fact that one of the primary fuses had blown and he saw no reason why the switch should break down. He stated that the operator attempted to start this particular motor by throwing in the switch and cutting out his control resistance, but the motor would not start, so he pulled the switch, without cutting in the resistance again, with the result that the switch broke down. The flash, however, did not injure the operator, as the cabinet door was locked shut. It thus took an accident to arouse the superintendent's attention to the dangerous condition in his plant, and I called on him again to explain that the primary transformer fuses are required to carry the electrical load of the entire plant, and when the one primary fuse on a three-phase delta system "blew" that two phases were "open circuited" and in this particular case, the 100 h.p. motor had a dead-short on the one remaining phase of about 2,000 amperes. What do you think would have been the possibility of the operator escaping alive if he had come in contact with this current? This is merely an example to prove the value of safety switches and of keeping the cabinet doors locked.

Our remedy for this "padding" ill which seems to be the indoor sport for the average person who knows very little about electricity, is to have a thoroughly experienced man in charge of this important phase of electrical safety. By having distribution circuits fused with the proper fuses and keeping circuit breakers adjusted to the minimum required to carry the load, we are giving the victim a chance, as when either of the above "blow", the circuit is opened.

FUSES ON ALL MOTORS OF FIVE HORSE POWER OF LESS, STARTING DIRECT ON THE LINE

A starting switch should be used which provides for a starting and a running fuse. The current required for starting is 100 per cent greater than the current required for running. Start is, therefore, made on one fuse; after the motor works up speed it throws over onto another fuse half the capacity of the starting fuse.

EXTENSIONS AND DROP CORDS

Avoid as far as possible the use of extensions and drop cords. Should these be absolutely necessary, use only the best reinforced cord. These

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should not lie on the floor, as some object running over them would break down the insulation. Avoid the use of brass sockets as they often ground and cause serious burns if the person is standing in a grounded condition. The socket used on an extension should be a porcelain shell socket, having no exposed live parts and equipped with a wooden handle.

PROTECTION ON MOTOR AND ON OTHER EXPOSED CONNECTIONS

Careful consideration should be given all motor leads, compensator leads, etc., having exposed connectors. These should be well taped with rubber and friction tape, thus lessening the possibilities of the friction tape alone becoming saturated and causing a leakage.

ELECTRICAL DEPARTMENT

An industrial plant may be equipped electrically in the best possible manner, but some member of the electrical department may put in a temporary job or use an extension while he is working on a job, with a cock-sure idea that the work is only temporary or that he will be the only person to handle this "jumble." As safety men, we should do everything in our power to prevent this.

THE ELIMINATION OF GROUNDED CONDITIONS

As we all know, damp conditions usually exist at one place or another in all industrial plants; especially if the floor is located below ground level. Environments of this kind are ideal conditions to produce a shock sufficient to cause death to a person coming in contact with a live electrical circuit.

The possibilities of a person receiving a fatal shock under these conditions can be greatly reduced by the grounding of all dead-metal parts on the electrical equipment. By dead-metal parts we refer to conduit switch cabinets, motor frames, etc. As the resistance of the body is far higher than that of a metallic circuit the current passing through the body will be almost nil. A ground protection not only protects the operator from receiving the majority of the shock, but if any live side of the circuit should become grounded, the current will pass to the ground and if the circuit is fused to the right capacity, it will cause the fuses to blow, which is the signal of a condition which must be remedied. Ground wires should be the same size as the circuit wires and should be preferably grounded to the water system at the nearest point where it enters the building.

Our responsibilities are getting larger every day, as the use of electricity is becoming more extensive. In closing, let me warn you of the greatest of all hazards, "procrastination." By making safety alterations today, you may save a life tomorrow.

ELECTION OF OFFICERS

MR. CARSON: The members of the nominating committee nominate Mr. August L. Kaems, Safety Engineer for the Simmons Company, Keno-

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sha, Wis., for chairman; Mr. E. F. Blank, Safety Director of the Buick Motor Company, Flint, Mich, for vice-chairman; and Mr. M. K Averill, Insurance Manager for Dodge Brothers, Detroit, for secretary.

(It was voted, upon motion duly seconded, to adopt the report of the nominating committee.)

DISCUSSION

MR. SIMPSON: Many of our machines are equipped with a two-wire cutout push button at the right hand of each operator. In case anything is caught in the machinery, all you have to do is to push that cut-out switch; or it can be stopped by a compensator; also at your distribution point, there is your knife-blade switch. On 550 volt A. C. currents we use the oil compensators.

MR. KAEMS: The disconnecting switch is really a minor point in the installation, as I see it. The important part is to have satisfactory compensators; because if you don't have them, no safety switch is going to give you the protection you need. The function of the safety switch is to disconnect your compensator which is your real working switch, in case of trouble. Safety switches are disconnecting switches, not operating switches.

MR. SIMPSON: We have found it advisable to place metal cages over motor commutators. In one case, a piece of waste slid off the top of the motor, and went into the rotator. A fellow grabbed for it—

CHAIRMAN SHAW: We require on 440 volts that every operator go through a physical examination to see if his heart is O. K.

MR. HAWES: Every person in the country should be thoroughly trained in the prone pressure method of artificial respiration. We had a fatality in one of the plants we carry; the man was breathing and still alive when they shook him loose from the current, but died before they could get him into the first-aid station. Had the man who found him immediately started artificial respiration, doubtless the victim would have lived. The Edison Company in Detroit had one case that I know of; they saved the life of a man who had come into contact with 2,200 volts.

FIRE PREVENTION

T. ALFRED FLEMING, SUPERVISOR, CONSERVATION DEPARTMENT, THE NATIONAL BOARD OF FIRE UNDERWRITERS, NEW YORK CITY

For years we have been content to accept figures involving life loss from fire as approximately 5,000 per year. Even this was appalling, but carefully tabulated statistics show that last year nearly 15,000 persons were burned to death and approximately 20,000 injured, a large percentage of whom were injured permanently and made a public charge. A classification of these losses shows that over 70 per cent are women and children of school age and under. This shows that the home and school have been neglected in our great scheme of safety education. It also shows the effectiveness of the general campaign of safety in the shop and factory.

Coincident with this loss of life, the destruction of property during

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1920 as quoted by Mr. W. E. Mallalieu, General Manager of the National Board of Fire Underwriters, almost doubled that of any previous year of our history, reaching an enormous total of over $505,000,000 (which does not include the stupendous losses in forestry), 90 per cent of which is due to carelessness of citizens. This waste of our national wealth of nearly one and one-half millions a day is paid for by every citizen of the nation. It is generally considered that these losses are borne largely by insurance companies, which is true, but insurance companies are only collecting and distributing agencies and of necessity are compelled to require increased rates to cover increased losses. Every product purchased for the home in food, furnishing, or wearing apparel; or for the factory in essential requisites for production has in its cost to the consumer an amount to cover the insurance and overhead cost as well as that of regular production. In this way in the last analysis the losses of property from fire find their way and are borne by every citizen of the country in increased prices for necessities. It is the largest and most unnecessary leakage of the country's resources, and is almost entirely avoidable.

Paul C. Redington of the forestry division of the United States Government in an address in California recently stated that of 20,244 forest fires caused by campers last year 76 per cent or over 15,000 were due to smokers' carelessness.

EDUCATION THE ONLY SOLUTION

It would seem that the only way to eliminate these tremendous losses of life and property would be to conduct the longest possible continuous campaign of education for their elimination. Many of these losses come from people who know better but forget the apparent trifles. For example: an eminent fire prevention engineer who has devoted his time exclusively to this cause for over fifteen years and who is considerd a national authority, was working on his automobile. He had an unlighted cigar in his mouth. Finishing his work, he proceeded to wash the grease from his hands by releasing gasoline from the carburetor. With his hands wet with gasoline he took from his pocket a match and lighted it for his cigar, which immediately set the gasoline fumes on fire. He escaped serious burns only by accident. During the afternoon on the same job he was on the point of repeating the act, when his common sense corrected the mistake which almost always proves fatal.

In a western city a fire prevention expert engaged by a large corporation was called to make an investigation of a condition of electrolysis which operated on the gas mains. Entering a cellar where gas had been reported as leaking he proceeded to investigate and without thinking, forgetting the flashlight in his pocket, he lighted a match to inspect the meter. The house was shattered and his lifeless body was removed with those of two others who were seriously injured by the shock.

From the above it is clear that the activity of our campaign must thoroughly impress our own forces first.

HOME AND SCHOOL MOST NEGLECTED IN FIRE PREVENTION

The places where safety has been most neglected are the home and the school. These are the places where the young and the aged, the help-

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less and the dependent spend most of their time. It is an appalling fact that not one business man out of every 200 has ever applied the knowledge of safety he has used in his factory to his home. He has forgotten to call a "cabinet meeting" of the members of his family and servants to instruct them in the necessities of safety—how to turn in an alarm, how to extinguish a fire in its incipiency, how to avoid danger from articles used in the home and how to use the extinguishers he has installed. In fact the usual employer who insists on proper extinguishers in his factory and the knowledge of their use by his employees, almost always forgets all of these precautions in his home. In other words financial value in production has 1,000 per cent more care and oversight than the priceless jewels of human life in the home, and yet the nation is only as large or as strong as its homes.

Similar negligence is shown in the care, maintenance and construction of our schools. A very small percentage of the members of our present boards of education have assumed more than the financial burden of school activities; they are equally responsible for the moral and physical safety of each child under their care. There is a very great disregard of properly established rules of safety in the construction of new buildings and the remodelling of old structures. It has been found by experts, that over 90 per cent of the school buildings are more unsafe either structurally or in maintenance than the Collinwood school was when it burned causing the death of one hundred and seventy-three children and three teachers. More than five schools burn in the United States for each day of the year.

Trifles due to carelessness or thoughtlessness are the causes of the largest percentage of fire casualties and conflagrations. It was a static spark from a belt running untrue that ignited the dust in a large mill costing the lives of 35 workmen, injury to 78 more, and a property loss the citizens had to pay of $5,000,000.

A boy playing with a yarn ball bounced it into the fire. He extricated it and kicked it outdoors. It was carried by the wind into a pile of shavings and from this came the great conflagration of Nashville, Tenn., with all its appalling loss of life and property.

An electric iron with the current turned on was left in the rear of a millinery store. The fire which followed spread over the city of Augusta, Ga., causing wreck and ruin with a loss of $5,000,000 in property.

A spark on a delapidated shingle roof from a passing engine caused the burning of Paris, Tex., with a property loss of over $7,000,000.

A cigarette butt in the Triangle Shirtwaist Factory resulted in a fire causing the death of one hundred and forty-five people. Another cigarette dropped through a bull's eye in the sidewalk burned eighty blocks of the city of Baltimore and cost $40,000,000.

These are but trifling causes scarcely believable; but think of the consequences.

UNPROTECTED VERTICAL OPENINGS RESPONSIBLE FOR 90 PER CENT OF LIFE LOSS

It has been said by an eminent authority that 90 per cent of our loss of life is due to unprotected vertical openings. I firmly believe this is

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true. It is the vertical opening left unprotected that allows the fire to spread through the buildings or to the adjoining area. Lack of proper fire windows, shutters, water curtains; open stairways and elevator shafts, lack of fire doors between divisions of main buildings, this is what traps the workman at his bench or the clerk making her sales.

The above, coupled with improper fire exit facilities, spells the death sentence of thousands. It is a travesty on the present high standards of mental development to note the useless sham involved in 90 per cent of our present exit facilities. Fire escapes constructed against the sides of buildings and passing ordinary glass windows, eliminating their utility after the first puff of flame from the window below. Spiral slides erected inside of a steel enclosure, frequently found locked with a padlock at the exit door below, only prepare a more horrible death by roasting, while deluding many with a surrounding of apparent safety. I personally found three of these traps locked with Yale padlocks, whose keys were lost—even while twenty-eight rooms of the school they were supposed to serve were in session. Who shoulders the enormous responsibility of this dreadful carelessness of maintenance and equipment?

It is the duty of every employer of help, every member of boards of education and every home owner to realize that he personally must assume the liability and provide 100 per cent safety to those for whom he is responsible. It is also the duty of every workman, and every pupil in school, to assist in the maintenance and the thoughtful use of every device installed for public safety.

Rapid progress is now being made by all forces dealing in public safety. You have established safety schools for superintendents and foremen in many cities—and in some places have been able to place a course of safety in the school curriculum under supervision of a safety man. This is the work that will count for succeeding generations. Let us prepare the young, while we protect the old, for a better ideal of safeguarding life and property.

DISCUSSION

Mr. C. B. Auel (Manager, Employees' Service Department, Westinghouse Electric and Manufacturing Company, East Pittsburgh, Pa.): I find that the Detroit Edison Company have placed red tags on all of their fire extinguishers, warning their employees against squirting the liquid on each other, even though a person's clothing is on fire. I presume the liquid was carbon tetrachloride. Perhaps they realize that carbon tetrachloride gives off offensive and noxious fumes.

Mr. Fleming: Carbon tetrachloride should not be applied to a person on fire. There are better methods of extinguishing such fires.

Mr. B. E. Broadwell (Republic Carbon Company, Inc., Niagara Falls, N. Y.): Two or three years ago a large coke mill caught on fire and 200,000 tons of coke started to burn. We tried to extinguish it with carbon tetrachloride but fumes arose which made it impossible for the men to get near the fire. Are these fumes poisonous?

Mr. Fleming: I think so. When applying carbon tetrachloride we want to apply it and then get away.

Mr. Broadwell: What do you recommend to extinguish coke fires?

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MR. E. E. ROGERS (Texas Oil Company): We put out our fires in coke mills by putting in steam. It works very satisfactorily in enclosed places. It expels the air and puts out the fire very rapidly.

MR. BROADWELL: These bins are not air-tight. As a result when we add steam, we make water gas which increases the intensity of the fire.

MR. FLEMING: It is particularly dangerous to use carbon tetrachloride where there is a possibility of its coming into contact with sulphuric acid; then you generate the deadly phosgene gas.

DUST EXPLOSIONS—THEIR NATURE, CAUSES, AND METHODS OF PREVENTION

DAVID J. PRICE, ENGINEER IN CHARGE OF DEVELOPMENT WORK, BUREAU OF CHEMISTRY, U. S. DEPARTMENT OF AGRICULTURE, WASHINGTON, D. C.

At the last congress of the National Safety Council in Milwaukee in September, 1920, in presenting the subject of grain dust explosion hazards it was stated that as a result of six disastrous dust explosions in the industrial plants of the United States and Canada, eighty lives had been lost and several million dollars worth of foodstuffs and property were destroyed. During the past year there has occurred in this country the most destructive explosion on record. On March 26, 1921, the largest grain elevator in the world, located at South Chicago, Ill., was badly damaged by an explosion of grain dust. The elevator was built of fire resistive material and credited with embodying the latest engineering principles of modern construction. In fact it was so constructed and equipped that the owners of the property did not consider fire insurance essential. No explosion insurance was carried since the destruction by explosion had apparently not been considered. The explosion caused the distruction of about $2,000,000 worth of grain and equipment, and about $1,750,000 damage to property—a total of about $3,750,000, with a loss of six lives. The explosion occurred late Saturday afternoon when the plant was not in operation, and only a few men were working, cleaning the driers. This accounts for the small loss of life in such an extensive and destructive explosion. It is reasonable to suppose that the loss of life would have been very great if the explosion had occurred during the normal working period.

Reference is made to this explosion because it has thrown new light on the dust explosion question and indicates the importance of full recognition of the dangers of explosive dusts. There is not as much attention being given to these dangers as there should be.

We readily recall the recent explosion that destroyed the ZR-2 and caused wide interest throughout the country owing to the extent of damage and the loss of forty lives. Is it going to require similar catastrophes in our industrial plants with larger losses of life before we adopt precautionary measures and take the necessary steps to properly control explosive dust conditions? In an explosion of starch in a middle west factory a little over two years ago forty-three lives were lost and approximately $3,000,000 worth of property destroyed. This disaster seemed to

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create but little general interest outside of the trade. Are we reconciling ourselves to the fact that our industrial plants must be subject to these dust explosions as a matter of course in their operation? Would not the common sense thing be to endeavor to control the conditions under which the dusts are produced and thereby prevent the explosion from assuming violent proportions?

From the results of the investigation of a large number of dust explosions in the United States and Canada by engineers of the U. S. Bureau of Chemistry, it can be safely stated that the explosive hazard of industrial plant dusts is not fully appreciated, first by many owners and operators, and second, by the general public. Safety application seems to follow great accidents or catastrophes such as the Titanic disaster, or the Iroquois theater fire. This has been true also insofar as coal mine explosions are concerned, since records show that as a result of several explosions in 1907 in which 1,148 miners lost their lives—648 were killed in December alone—the federal Bureau of Mines was created and experimental work was started leading to the adoption of prevention methods.

NATURE OF DUST EXPLOSIONS

It should not be difficult to understand the nature of dust explosions and the conditions under which they can occur. We readily accept the fact that when certain flammable gases such as methane, hydrogen, and others are mixed with proper proportions of air the mixture can be ignited with explosive force. The flame from the original ignition spreads in all directions from one gas molecule to another at a very rapid rate, until sufficient pressure is developed to reach the explosion stage. In the case of methane gas (CH_4) the explosive mixture is reached when 5.5 per cent of the gas combines with 94.5 per cent of air, and is sometimes referred to as the lower explosive limit. When there is present 9.6 per cent of methane and 90.4 per cent of air, a mixture is formed that produces the highest pressure upon ignition. The higher explosive limit is reached when there is present about 14 per cent of gas and 86 per cent of air. The explosive range of methane is therefore considered to be between 5.5 per cent and 14 per cent of gas, known as the lower and higher limits. Similar percentages prevail when other explosive gases are considered.

Reference is made to the explosive gases, since the experimental work with explosive dusts has shown that a dust explosion is very similar in action and nature to a gas explosion. The nearer the size of the particles in the dust cloud approaches the size of the gas molecules, the more rapid the rate of flame travel or propagation, and the more violent the explosion. In other words, one of the principal determining characteristics of the relative explosibility of a dust is the degree of fineness. Of course, other factors such as moisture content, tendency to form a cloud, and nature and character of ignition source are all to be considered when various dusts are compared.

Remembering, then, that the finer the dust particles, the more violent the explosion, we can more readily picture in our minds what follows when the dust in suspension comes in contact with the proper source of ignition, since it behaves as a gas and air mixture. With a proper amount

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of dust in the air the rate of flame travel becomes so rapid that excessive pressures are developed, resulting in extensive losses of life and property. It is, therefore, essential that we recognize the explosive dust danger, just as we do the explosive gas hazard, and that we apply similar precautionary measures. We cannot expect to secure adequate protection in our industrial plants until we fully realize the potential possibilities of dusts, and realize that they are as dangerous as explosive gases. This seems to be a factor which is lacking in our present industrial safety work. We are too much inclined to look up the dust hazard as a remote possibility, not an ever present danger.

TIME OF EXPLOSIONS

In the investigation of dust explosions in industrial establishments many interesting problems and questions have arisen. It can readily be undertood how difficult it is to undertake the study of a disastrous explosion when the entire property is completely destroyed and all the workmen in the plant have been killed, with the result that there are no survivors remaining to assist in establishing the possible cause. In spite of this apparent difficulty, however, considerable progress has been made in locating the origin of the explosion and the circumstances under which it occurred.

It is significant to note, however, that the most disastrous explosions in the industrial plants of the United States and Canada have occurred at a time in the day when the plant was not in normal operation or operating at full capacity. The psychology of this coincidence has raised a prominent question in the minds of investigating engineers and should be of marked interest to those engaged in safety work.

The recent disastrous explosion in the Northwestern elevator at South Chicago occurred on Saturday evening at six o'clock when a force of six workmen (all of whom were killed) were engaged in cleaning a grain drier. The plant had closed down at noon and was not in operation at the time of the explosion. This is typical of a number of our most disastrous dust explosions in recent years, especially in grain elevators. In an elevator in the southwest fourteen men were killed in an explosion that occurred at 2 o'clock in the afternoon during a cleaning-up period. This explosion also occurred on Saturday after the plant had been shut down at noon. Very few of the men in the elevator escaped with their lives.

In another case in an elevator in Canada, again on Saturday, during the noon hour an explosion caused the loss of ten lives—four men in the elevator and six on a barge nearby.

The most disastrous dust explosion on record insofar as loss of life is concerned took place at 6:20 in the evening—after the normal working period of the day, and after the day force had left the plant. The explosion resulted in the loss of forty-three lives and approximately $3.000.000 damage.

In considering the cases mentioned and others somewhat parallel, two very pertinent questions naturally arise.

First, does the fact that the largest number of dust explosions in indus-

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trial plants have occurred at times when the plant was not operating to normal capacity, suggest any relation to possible causes?

Second: considering the large percentage of life loss, what would be the result to be expected, following an extensive dust explosion in our industrial plants, while the maximum force was at work?

In the first question raised it would appear that possibly some reasons can be advanced for the frequency of dust explosions either after normal working hours, during the noon hour, or toward the end of the day. It may be the tendency for the workmen, as the end of the day approaches, to neglect observing certain mechanical defects in the operating equipment and presume that they will be detected and remedied by the workmen on the succeeding shift. This involves the question of fatigue in the performance of the day's work and the possibility of a reduction in the sense of keenness of the workman to detect possible causes of explosion and fire. The tendency to slack up in making thorough inspections toward the close of the working period, may also permit possible causes to originate, that are accordingly overlooked. The delay of inspection by the succeeding shift would allow this defect to reach a serious stage before discovered. This would be particularly true in case of a hot box, overheated journal, hot motor, defective electric equipment, and similar causes.

The second question must be regarded with proper seriousness. The percentage of life loss in all these dust explosions based on number of workmen present has been high. In fact, very few employees are able to escape from the plant when the explosion starts, which means that the life loss is almost complete. When we stop to consider that the cases already mentioned have not occurred during actual operation, we can readily see that a dust explosion in a large industrial plant would indeed be a serious catastrophe if it should occur at a time when the full working force is present. This emphasizes clearly the necessity of proper regard for this new type of industrial hazard, and the adoption of effective precautionary measures.

TYPE OF INDUSTRIES

Although the investigations conducted by the Department of Agriculture have been concerned primarily with explosions and fires that occur during the handling, milling, or threshing of grain, it must not be concluded that this is the only industry which is subject to this hazard. Large losses of life and extensive damage to foodstuffs and property have resulted from dust explosions in starch factories, sugar refineries, cocoa and chocolate plants, spice works, woodworking establishments, paper mills, shoe factories, and similar types of industries. An explosion of aluminum dust in a Wisconsin plant resulted in the loss of six lives, while a little later there was an explosion of hard rubber dust in a Michigan factory in which nine men were killed and the property considerably damaged.

From the series of dust explosions that have been occurring in our representative industries we must conclude that these dust explosions can occur in any type of industrial plant where explosive dusts are creat-

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ed during the operating processes. By explosive dusts is meant any dust that will burn or can be ignited, since experiments have shown that dusts which burn are readily ignited and propagate flame rapidly, building up sufficient pressure to assume explosion proportions.

CAUSES OF DUST EXPLOSIONS

Numerous explosions of dust in industrial plants have been caused by the use of open flames, such as lanterns, torches, matches, and gas jets in dusty atmospheres. No one doubts that gas explodes when these sources of ignition are introduced into gaseous mixtures of proper proportions. Why should we feel that it is difficult to ignite dust under similar conditions? Many explosions of dust are on record due to the use of open flames in plants and factories where dust was created during the operating processes.

The investigation of a large number of disastrous dust explosions in modern up-to-date industrial plants in recent years has added a number of new causes to the original so-called "simple" or "common list." It was not generally believed that the breaking of an incandescent electric lamp bulb in a dust cloud might result in an explosion. Tests conducted by the Bureau of Chemistry in co-operation with a number of large manufacturing companies showed that this is true with all types of lamps, and that the explosion follows immediately the breaking of the lamp. In addition, the tests showed that under certain conditions light fluffy dusts, settling on lamp globes, would result in dust fires. (Department of Agriculture Circular No. 171.)

A number of recent explosions have originated in the exhaust fan installed for the removal of fine dust from buffing or polishing wheels, or from certain types of milling equipment. The sparks produced by foreign material passing through the fan and striking the blades, or the blades becoming loose, ignites the fine cloud of dust passing through the fan. Disastrous losses assigned to this cause have been recently experienced in representative lines of industry.

The attention of the department has been called to the large number of explosions in which static electricity has appeared to play a prominent part. As a result of the investigations of disastrous losses from explosions and fires in grain threshing machines in certain grain growing sections it has been generally accepted that static electrical discharges will ignite dusts. Early in July of this year an explosion of minor proportions occurred in a large eastern terminal grain elevator. The explosion started in a concrete grain bin while a quantity of corn was being run into the bin. Although the cause of the explosion was not definitely determined, one of the possible causes suggested was static electricity produced by the grain or foreign material passing through the metal spout leading into the bin. It is felt that an active effort should be made to control this cause in all parts of the plant where static electricity may be produced.

In our industrial operations it should be generally accepted that any source that will ignite gas, will ignite dust and cause an explosion if the dust is in suspension in proper proportions.

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DUST CONTROL

The ignition of a small quantity or "pocket" of dust in suspension results in a primary flash or explosion of small proportions. The concussion, however, is sufficient to shake into suspension all the dust that has settled, lodged, or accumulated on ledges, beams, girders, machinery parts, and inaccessible points in the plant. This dust feeds the flame or fire from the first or primary explosion and results in a secondary explosion of large proportions in which high pressure is built up and considerable violence is manifested. In a recent explosion the greatest damage was done at the point farthest from the origin. This has been true in a number of instances and is quite the reverse of an explosion of detonating materials where we are inclined to expect the greatest violence at the point of origin. The importance of removing and controlling the so called static dust is a vital factor in dust explosion prevention. If there is not sufficient dust present to permit the flame from the primary explosion to propagate, it gradually dies down and the explosion only assumes minor limited proportion. The reverse is true if sufficient dust is allowed to accumulate throughout the plant during the operating periods.

EXHAUST FANS

In considering dust control it is felt that attention should be called to the explosions that have originated in the exhaust fan installed in the system. In connection with the removal of fine dust from buffing and polishing wheels, grinding rolls, and similar equipment, exhaust fans are installed in many representative industries. The fine dust, for sanitary reasons principally, is drawn from the source of production, through pipe trunking, into the exhaust fan and then blown into the collecting device.

An explosive mixture may be formed when the dust passes through the fan, and all that is needed to start the explosion is the ignition. This may be sparks from a broken fan blade or from foreign material such as bolts, nuts, screws, etc., passing through the fan. This cause is mentioned since a number of disastrous explosions have been associated with the exhaust fan; dust collection engineers are now giving consideration to a possible rearrangement of the fan location in the dust removal system.

The explosion of aluminum dust already referred to was attributed to metallic sparks produced by a piece of wire striking the fan blades and igniting the dust in suspension. Explosions of chocolate dust causing extensive life and property losses have originated from foreign material entering the exhaust fan. A violent explosion of flour dust was assigned to sparks produced by the exhaust fan slipping on the shaft.

METHODS OF PREVENTION

It is difficult for a dust explosion to originate unless the dust and air are mixed in explosive proportions. It has been possible for flame to propagate through dust clouds when about 1/50 of an ounce of dust was

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present per cubic foot of air. An effective way to prevent dust explosions would naturally be to prevent, if possible, the formation of explosive dust clouds and to eliminate the source or cause of ignition. This is especially true with open flames and the simple causes already referred to.

Electric lamp bulbs located in parts of the plant where explosive dusts are created should be protected with vapor-proof equipment and precautions taken to prevent dust ignition by sparks from motors, switches, or blown fuses. Effective precautionary measures should be adopted for the control of static electricity produced by operating mechanical equipment.

It would appear logical to conclude that the best way to prevent dust explosions would be to adopt measures to prevent the dust from collecting or accumulating throughout the plant. It is always harder to stamp out a disease after it has once started than to adopt the necessary sanitary measures to prevent the disease from taking hold. This procedure can generally be followed in our industrial establishments by the introduction of improved types of dust collecting appliances. In some of our grain handling plants such as grain elevators, existing commercial regulations prohibit the removal of any dust between the point of receipt and the point of weight. This regulation has been considered essential in order to maintain uniform weight between shipper and receiver. It was originated before the dust explosion hazard in grain elevators was fully recognized.

Since the most destructive explosions in recent years in the United States and Canada have occurred in grain elevators it is very essential that this problem be satisfactorily adjusted. The existing regulations permit the dust to escape throughout the entire plant and accumulate in dangerous quantities. When the original ignition occurs the dust is shaken into suspension and results in a secondary explosion of large proportions.

Construction is closely related to dust explosion prevention and should be of a type that will not permit dust to accumulate in dangerous quantities. Although a plant may be constructed of so-called fire resistive material and cannot burn up, it has been well demonstrated that it can be blown up by dust explosions. The plant must be well maintained and proper attention given in the design and construction to adoption of effective precautionary measures for dust explosion prevention.

(Following his paper, Mr. Price demonstrated with a model grain elevator the results of dust explosions.)

PUNCH PRESSES—DESIGN OF DIES, AUTOMATIC FEEDS, AND SAFEGUARDS

August L. Kaems, Safety Engineer, The Simmons Company, Kenosha, Wis.

Punch press accidents happen because the employees in many plants are required to place their hands underneath the ram of the press twice

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for each operation. Suppose a man does 1,000 pieces per hour, that means that his hand is in the danger zone 2,000 times per hour. In 8 hours it would be 16,000 times, and in 300 days it would be 4,800,000 times. Is it any wonder that our press accidents are increasing? You will agree with me that when a person is compelled to flirt with danger 4,800,000 times per year without being injured, he is just lucky, and the only way to stop this is to make it unnecessary for him to place his hand in the danger zone. Can this be done. I say it can be done in 90 per cent of the work.

The Simmons Company in 1920 had a bad record for punch press accidents. They had 426 presses in operation and lost 36 fingers on them in 1919, one department losing 24 out of the 36; so you can readily see I had some patients to practice on. We reduced these to 9 fingers in 1920, 6 of the 9 fingers being lost in the first 6 months and the other 3 in the last 6 months. In the first 6 months of 1921, we had one punch press accident, losing the tip of one finger. The department that had lost 24 fingers in 1919, has gone from August 2, 1920, up to date without an accident. I believe this is some record and shows what can be done.

We started in the department that had the most accidents. We found out what caused them and removed the causes, always trying to make it possible for the operator to get the material in and out of the die without placing hand under the ram. One thing we are particularly proud of: we have not thrown away a single die. We took the tools we had and made them safe. Of course, we have built some automatic feeds, but these can only be used where you have large runs. One of the troubles we had to overcome was the tool maker, who cannot change his ways of doing things. Just as soon as you say you are going to make a change on the die, he thinks you are casting reflections on his work. There are many things to be taken into consideration, which seem simple enough, yet they all play an important part in this work. You must consider the shape of the piece, determine which way it will slide easiest into die and cause it to locate itself in the die properly. We have worked off and on for six months on certain jobs until the right way was found.

Many people say, "You have a large shop and have long runs, but we have a small plant with short runs." True, we have a large shop but we do a great deal of our work in just the same way as the small shop, for one department will order a small lot of one kind while another department does the same, and for that reason we are continually changing from job to job. It isn't anything unusual to see a press changed several times a day.

Our experience has been whenever we made a job safe we also increased production from 15 per cent to 150 per cent. This has always been doubted by production men, but when they tried out this scheme they got the same results.

In concluding let me emphasize how necessary it is that you place a competent person in charge of this work, and let him alone, for he cannot accomplish anything if he is continually hampered.

(Mr. Kaems exhibited a number of dies and demonstrated the device

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which he has arranged, enabling the operators to slide into the die—instead of placing by hand—pieces of irregular sizes and shapes.)

DISCUSSION

MR. AUEL: Our company has gone into this proposition as far as Mr. Kaem's company, but we must not lose sight of the fact that even after our punch presses are all made safe, accidents still result from tripping, falling, dropping dies on the feet, swinging hands against the corners of sharp metals, etc. It is, therefore, necessary to continue our educational safety work through safety bulletins and the other activities of the good all-around safety department.

In addition every die should have bolts so that we can more easily lift up and set down a die.

When you have an accident in the punch press shop, it is more or less severe; and I am reaching the conclusion that you must come to physical examinations. Then when you have an accident in the punch shop, it will not be disabling to the extent that many of them now are, and which are not the result of the accident so much as the result of the physical condition of the fellow previous to the accident.

We have developed a number of devices; the short arm for instance. One type is simply a long, flat wooden device, on the end of which is a disk of felt. That disk is dipped in oil from time to time to swab the die. We also have electro-magnetic fingers, as we call them, shaped something like a horse-shoe, on the end of which is a handle. These can be put in the press to lift pieces out.

We have just developed a little sucking device much like the leather disk we used as youngsters to pull up the side-walk. Wet the leather and you get enough suction to raise a small paving stone. This thing goes a step beyond the other two devices, in that you can not only lift a thing into the press, but you can lift it out of the press; and, furthermore, it need not be a perfectly flat shape. This leather disk is attached to one end of a small brass tube; on the other end of the tube is an atomizer bulb. By just laying the disk on the piece to be punched, without even squeezing the bulb, you can lift that piece up, set it in the press, give the bulb a slight squeeze and release it. If you are interested, write Mr. Shaw, and we will be glad to supply you with blueprints of not only that, but any of our other devices; you are free to make them for your own use.

CHAIRMAN SHAW: The Ford Motor Company uses the push button device on large presses. I know a firm in Detroit where a young man lost two hands by falling into a press. On one of these large presses we have a sheave or pulley, with a cable passing over it, fitted with a gate. If a man's hand is in there, the gate will lift it out. Last week a large press broke and the whole plunger dropped; as a result the gate threw the man's hand out. The foreman describing it to me said, "You will never see those gates neglected again."

ADJOURNMENT.

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FRIDAY MORNING SESSION

Chairman Shaw called the meeting to order.

INDUSTRIAL SURGERY AND FIRST-AID

DR. T. A. MCCANN, DAYTON ENGINEERING LABORATORIES COMPANY, DAYTON, OHIO

First-aid work is a labor of love. When rightly managed it is the connecting link to co-operation between manager and laborer. The objects aimed at in a first-aid department are: conservation of human life, of human energy, human intelligence, human ingenuity, and human production. Those of us who are entrusted with first-aid work, need to be ever awake to the responsibility we have assumed. We are the greatest engineers in the world. The greatest machine used in every enterprise in human affairs in the world is the human machine. It is the business of the physician and surgeon and first-aid department to see that this machine at all times is in first class running order, always ready for action, always ready for duty.

The connecting link between the first-aid department and the family is the visiting nurse. This position is one whose importance I feel we cannot too highly emphasize. This individual is not a detective as is often expected of her, but a philanthropist. To obtain the best results in the house she must be an intelligent, refined, industrious, wide-awake, educated individual.

The head nurse in a first-aid department is, in my judgment, the most important individual in the whole works. She has more responsibility than the doctor himself, unless the doctor does nothing else but manage the department and spend his full time there. She should be a lady possessed with courage, sound judgment, intelligence, business ability, and a thorough knowledge of the whole nursing game. She must command and demand the respect of every individual who enters this department. She must be at the same time sympathetic, yet firm. She must be a student of psychology and be able to read the character of the individual who enters for care. She must be able to determine between a real sufferer and a quitter. She must be a commander of her forces. After efficiency in all the repair departments has been rendered 100 per cent, a complete record of all that occurs there is essential. She sees that her assistants do this perfectly.

CONTENTMENT AND HAPPINESS OF EMPLOYEES ESSENTIAL TO SUCCESS

Contentment and happiness are essential to the fullest measure of success in any institution. No effort has been spared in the Delco Company to see that every man, woman and child connected directly or indirectly with this company has his interests looked after not only in the factory but also in the home. When the disastrous flood struck Dayton, the company, through its welfare department, repaired and put

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in order sixty-five homes. We do this on the basis that no unhappy individual can digest a meal or be physically 100 per cent efficient.

The Blue Bird club which is indirectly connected with the first-aid department, and of which my head nurse was chairman for a long time, plays a large part in seeing that everybody in the factory is kept in a happy frame of mind.

The welfare organization and the relief association are always awake to the best interests of every individual connected with this firm. I cannot commend all these organizations too highly for what they have accomplished and the part they play in making this one of the happiest and most contented organizations in the world.

Now, as to the surgical aspect of our work. It takes a barrel of alcohol when we are running full force every six weeks to supply our needs, and I would stake the last dollar I possess that never a teaspoonful of this ever went down the throat of anybody. This alcohol is used to make a soap we have used in our works since the origin of the company. It is also used in making the different dilutions of iodine used for the primary dressing of wounds.

Our soap used to cost us $10 per gallon when alcohol was at its highest mark, but even then it was the most economical thing we could buy because it was the most efficient. Thinking that someone may want to follow our extravagant method, I will give the formula for this soap: to one gallon of grain alcohol add 25 pounds of green soap made from olive oil; dissolve the soap by agitation. Let this stand till clear in glass jars and decant the clear liquid. Add 4 ounces of oil of lavender flowers to the gallon.

TREATMENT OF WOUNDS

The great underlying principles of traumatic surgery are the same the world over. Our surgical cases are practically all handled the same way and have been for the past ten years. First they are cleansed thoroughly with the above described soap, undiluted alcohol is then applied, ragged and torn tissues removed, and wounds dressed in a 10 per cent solution of tincture of iodine in alcohol. If contusion has been marked we always soak the part in hot sterile water for as long a time as we can spare to relieve tension, swellings, and congestion. If we can keep our patient fairly clean we do not redress for seven days. If he is constantly bathed in oil, benzine, or soap solution, he must return for daily dressings. If the patient is so disabled that he cannot return to work we hand him a small vial of 2½ per cent iodine solution in alcohol and order him to dampen the wound every four hours. We seldom suture wounds, trusting very largely to bridge dressing for coaptation.

We probably have not used three yards of gauze in our work in the past five years. Long fibre cotton answers every purpose. We never use the short fibre cotton and never buy any cheap supplies.

In the past ten years work we have had one surgical death from concussion of the brain and one medical death from fatty degeneration of the heart. We keep a complete card index of every case treated either medically or surgically.

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We are particularly proud of two things which our records show: first, the efficiency of our aseptic and antiseptic precautions; second, our salvage of mutilated tissues until such time as it may be demonstrated that they can never be made useful. Any novice can remove fingers, hands, and toes, but it takes a mighty deft fingered surgeon to replace them and have them useful when once removed.

The following is a portion of our annual report for the year 1919:

New cases	4,757	Medical cases	6,705
Redressings	8,009	Revisits	3,726
Foreign bodies in eyes	848	Unclassified	15
Eye irritations	847		
Boils	339	Medical total	10,446
		Surgical total	14,800
Surgical total	14,800		
		General total	25,246

DISCUSSION

Dr. Ralph W. E. Elliott (Medical Director, National Lamp Works, Cleveland): Don't you use gauze except to hold the cotton in position? Does the long fibre of the cotton became entangled in the wound? Do you allow the patients to apply the primary dressing? Is the solution poured right through the primary dressing?

Dr. McCann: We never allow any patient to apply any dressing or remove any that has been applied. If you dampen the long fibre cotton with the ten per cent solution of tincture of iodine and alcohol, you will find it quite as firm as any gauze you can buy. It never gets tangled up. We don't use gauze at all, because we have no trouble with the cotton.

Dr. Elliott: If you have a gaping wound, and you apply that, and put your dressing on afterwards, do you know about where you have the cotton? It seems quite plausible if you have a gaping wound and you put your dressing (long fibre cotton) upon it and then you put your circular bandage around it, it is pretty hard to keep that cotton out of the mouth of the wound.

Dr. McCann: It is as easy as with gauze. When you dampen it, it is just as firm as gauze.

Chairman Shaw: Is cotton better than gauze?

Dr. McCann: We feel so, or we wouldn't use it.

Chairman Shaw: You don't condemn the use of gauze?

Dr. McCann: Not at all.

Mr. Hawes: The exposure in that plant last year was 1,133,150 hours worked. The time lost from accidents was a trifle over 5,000 hours.

Chairman Shaw: Don't you think it would be better for a nurse to do the dressing at the men's homes, instead of the men applying the dressing themselves? Also isn't there some danger of leaving the bottles around where children might get them?

Dr. McCann: No patient is ever allowed to look at his wound, let alone to dress it. If we send a man home with a wound, we tell him to

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come back to the shop after twenty-four hours if it hurts. If it doesn't and is comfortable after twenty-four hours, he doesn't need to show up for seven days; but under no circumstances is he allowed to touch that dressing, under penalty of no remuneration for the lost time.

CHAIRMAN SHAW: Do you maintain a doctor at your plant during Saturday afternoon and Sunday, and in the evenings so if a man has trouble, he can get assistance?

DR. MCCANN: There is an assistant in my office, who is accessible Saturday afternoon and Sunday.

SAFETY EDUCATON THROUGH MOTION PICTURES

DAVID S. BEYER, VICE-PRESIDENT AND CHIEF ENGINEER, LIBERTY MUTUAL INSURANCE COMPANY, BOSTON, MASS.

When Billy Sunday was in Boston one of my friends, who is a physician of an investigative turn of mind, started out to analyze the secret of the evangelist's success in interesting his audiences. He held his watch in his hand and he noticed that every four minutes Mr. Sunday gave his performance a complete turn, introducing a striking story, one of his famous telephone conversations with Heaven, or a gymnastic turn on top of the pulpit or on the floor. My friend kept up his observation for the first quarter of an hour and after that forgot to look at his watch; another tribute to the proof of the power of Mr. Sunday's attention-getting methods. He felt that Mr. Sunday understood perfectly the psychology of an audience, that the average individual is only capable of concentrating on a single idea for three or four minutes, after which his attention wanders unless it is recaptured by some striking expedient.

Without doubt some such theory explains the value of the motion picture in holding the attention of an audience. Literally a thousand separate impressions or pictures are flashed into the mind of the observer by the motion picture machine every minute. If the picture is a good one the attention is not allowed to lag for a second throughout the production.

It has been shown by educational tests that children learn certain facts in history or geography in a fractional part of the time where the material is enlivened by well selected moving pictures, that it takes to assimilate the same ideas by textual and oral instruction alone.

These are some of the reasons why the moving picture is such an effective medium for driving home the safety idea in the minds of the ordinary workmen. These men are not trained in listening to speeches, and it is difficult at best to hold their attention; but one has only to watch an audience from the rank and file sit throughout the showing of a safety film almost without the movement of a hand or the flutter of an eyelid, to know that the moving picture with its variety of action and its technical expedients for holding their interest, *does* grip their attention.

Motion picture programs also readily permit the introduction of short

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comedies or news reels which make a still greater appeal to the interest of the audience. By contrast with the comic, the serious element loses nothing of its effectiveness from the fact that the audience finds genuine entertainment in the program.

One of the most important steps in accident prevention is to give every individual a vivid impression of what an accident means, and to make clear the fact that *his* name may be the one that is to head tomorrow's casualty list. Motion pictures furnish probably the best single agency for putting this idea across.

RESULTS FROM SAFETY RALLIES

It is difficult to get employees to report trivial injuries to the first-aid room, and as a result of this neglect blood-poisoning often results. One plant reports that the week following an exhibition of "The Outlaw", in which a serious case of blood-poisoning is shown, the number of these minor injuries reported for treatment was more than doubled. Undoubtedly the attention that could thus be given must have prevented some cases of infection.

In another plant employing about three thousand workmen, where for a long time there had been from four to five lost time accidents every week, during the week following the exhibition of this picture there was not a single lost time accident, and the accident record for the following six months of the year was just half that of the previous six months. The succeeding year, in which additional safety rallies formed a part of the plant safety activities, showed a further reduction of 50 per cent.

Of course motion pictures will not perform miracles in accident prevention; the impression made at one showing tends to become dulled as time goes on, so that it needs a systematic follow-up in order to get lasting results. The use of films should be supplemented by other well-recognized safety activities in order to get the maximum reduction in accidents.

PICTURES AVAILABLE

There are a number of good safety and health pictures available, lists of which are kept by the National Safety Council and can be secured on application to headquarters in Chicago. Unfortunately, however, the number of such pictures is quite limited at the present time and the demand is much greater than the supply. It costs considerable money (at least $5,000 per 1,000 foot reel) to produce a good film of professional standards with real actors. So many people using educational and industrial films have been trained to believe that they should secure them for nothing, because advertising films have been produced for free distribution, that professional picture producers hesitate to undertake the production of safety and educational films because of the difficulty in securing a reasonable return on their investment. It will be necessary for the people using such films to appropriate sufficient funds to pay a reasonable rental or purchase price for the prints, before anything like an adequate supply of such pictures will be prepared.

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COST OF MOTION PICTURES

It is possible to become a motion picture "producer" with the outlay of practically no funds except the purchase price of a camera and films, hence there are dozens of concerns all over the country that offer to make motion pictures as low as 75 cents to $1 per foot of accepted negatives. Most of these people, however, have very limited knowledge and experience in motion picture work, and the results are rather "pictures of motion" instead of "moving pictures" in the accepted sense of the word. They compare to a real moving picture about as the ordinary amateur kodak picture compares with that of a high grade professional photographer.

Some idea of the cost of producing a first-class picture may be obtained from the fact that a good actor or actress (and I do not mean a star of the Mary Pickford or Douglas Fairbanks type) gets from two hundred to a thousand dollars a week; a good motion picture director gets from five hundred to a thousand dollars a week; and it takes three or four weeks under the best conditions to produce a two reel picture. The rental of a studio and the cost of "sets" or scenes involves an additional expenditure that quickly runs into thousands of dollars.

The motion picture committee of the National Safety Council hopes to produce some safety pictures in the course of the next year or two but in order to do so, it will be necessary to finance the pictures in advance, preferably by subscriptions from those who are in a position to use them, on a basis of about two hundred and fifty dollars per reel, as mentioned in the July issue of the *National Safety News*. If you are interested in this matter, please communicate with the chairman of the committee. Furthermore, don't fail to send in your ideas as to the material that should be included in such pictures; if you have in mind a story suitable for a scenario, jot it down in conversational form and let us have it.

FIRE HAZARD FROM FILMS

While the motion picture furnishes a splendid medium for spreading safety propaganda it has some inherent dangers that should not be lost sight of. The ordinary film such as shown in theatrical houses is made of a material commonly known as "celluloid"; it burns very rapidly. The oxygen necessary for combustion is contained in the film itself so it may continue to burn under water. There have been several fires from such films involving loss of life, one of these occurring in an ordinary railroad passenger car. Such films should only be shown in a fire-proof booth and there are additional regulations such as the provision of a fire extinguisher and a licensed operator for the machine in the laws of a good many states.

There is another type of film known as the safety or "non-flam" film which is no more flammable than ordinary newspaper and can be shown with safety in a portable machine. In order to guard against the substitution of flammable stock in a portable machine, however, several states such as Massachusetts and New York prohibit the use of standard width film in a portable machine.

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The regular commercial film is 1⅜ inches in width; there is a narrow standard, however, 1⅛ inches in width which has been developed in an effort to reduce the fire hazard. This can be shown anywhere without restriction, but there are practical difficulties involved in getting a supply of pictures on the narrow width, so it does not solve the problem very satisfactorily. The standard width non-flam film has the name of the maker and the words "Safety Film" printed in the margin at intervals of several inches so it can be readily identified.

SAFETY PROGRAMS

In working up a safety rally I think it is an excellent idea not to try to show more than one or two safety pictures, and to have some variety in the program. We generally start out with a news weekly, followed by an animated cartoon, and a short address on accident prevention, then featuring the safety picture, the whole program occupying not over an hour and three-quarters.

There has been considerable discussion as to whether a safety film should have "human interest" or whether a simple series of episodes is satisfactory. Undoubtedly both have their place.

DISCUSSION

CHAIRMAN SHAW: In a large plant, where you have a great number of departments, it is very hard to make a safety film that will appeal to all of them, and still carry a safety lesson. We have tried various ideas. For instance a man carrying a ladder the wrong way will stab a man with one end of it. A fellow will come along and show him how to carry it correctly. Our men, after seeing that reel carry the ladder correctly. If we see a man in the plant who doesn't carry the ladder correctly, we will ask him: Have you seen the motion picture?"—and nine out of ten say "No."

MR. H. C. WARD (Director of Safety, Michigan Mutual Liability Company, Detroit): How often should you show moving pictures to get the best results?

MR. BEYER: That is rather difficult to answer. I think it an excellent idea, where it can be arranged, to show pictures at least once a month or oftener. A large number of concerns are now putting in, or have already put in, motion picture rooms and use them as a part of their educational campaign in Americanization, and show films once a week or oftener.

MR. WARD: Which are of the most value, shows in the shops or in the community theaters?

MR. BEYER: I think that depends largely on the local situation. Both are equally valuable if you can get the people out. In a very large plant, it may be absolutely necessary to show the films by departments. If the plant is small, you can have a community show and get the people out very well. The best method that I think we have developed to get people out is to use a ticket exactly like a theatre ticket; these are distributed by

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of promise from the man that he will attend. He sells the thing individually to the man. He tells him it is going to be an interesting entertainment; and something about it. You seldom, however, get more than a the foreman, and as the ticket is given out the foreman exacts some sort fifty per cent return on the tickets given out in that way.

MR. ROY S. BONSIB (Chief Safety Inspector, Standard Oil Company, New York City): I want to emphasize the importance of giving out tickets; the mere fact that they accept tickets makes them feel obligated to attend. Furthermore, that little piece of pasteboard gives the new man confidence to go, when otherwise he might be timid. One important thing is to get a man's wife and children out too. If we can get women interested in the safety movement, we have a very vital factor.

In arranging programs it is important to have three elements. You must have comedy, to get people in the frame of mind to look at what you are going to give them later—a sort of appetizer. The man sees his wife laughing and he is happy because he has been able to make her laugh. Another element is romance. A woman can't live without romance. The third element is something mechanical to make the men link up the picture with conditions in the plant.

MR. M. J. CARROLL (American Sugar Refining Company): I am not going to say anything original; I just want to give this audience the advantage of the observations of Professor Cunningham of Harvard before the American Railway Association, on Monday. He observed that too much stimulation was a deterrent in safety work, because there was always a serious reaction after a person had been stimulated to a high degree; and that the process should be gradual, natural, and continuous.

He speaks of organization and individual co-operation. That seems to be closely related to the idea of distributing tickets for movie shows. I think the average workman understands that a ticket isn't necessary to get into a hall. If the tickets are taken up in a perfunctory manner at the door, there is some question as to whether they won't detect your motive in giving out the tickets. It seems preferable to create a spirit among the men that would cause them to want to come to the meeting, rather than to deceive them by way of a ticket. I am not speaking disparagingly of the ticket, if it could be associated with the general feeling on the part of the men that it is their job as much as it is the company's to make the meeting a success.

Professor Cunningham also emphasized the danger of putting too much stress upon safety devices. He illustrated his point by the observation that in extremely dangerous situations there were few casualties.

MR. HAWES: The Michigan Mutual Liability Company has experimented with the picture idea for some time. We have tried shop shows and shows in community theaters. We now consider it best to rent the best theater available, run the theater's comedy and feature films, follow these with a short, snappy, safety talk not over ten or fifteen minutes long, and wind up with two or three reels of safety films, getting through with a regular two hour show. Our experience has been "packed to the doors", at quarter after seven and "packed to the doors" again at quarter after nine. I feel that it is the way to reach all the men. They are

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there for the evening, sitting comfortably in chairs, no machinery to worry about, no distracting noises; they don't have to watch the clock, or listen for the bell. They are there for an evening's entertainment. One fellow asked, "Can I bring the children, I've got twelve?" I replied. "Bring them all along." We have given in the past year 285 performances, with a total attendance of 111,372 men.

MR. D. P. KENNEDY (Assistant Safety Engineer, Pittsburgh Plate Glass Company, Pittsburgh): We give out tickets and require the men to sign them before they are admitted. Thus we can check up on the number of men attending from the various departments.

MR. W. W. WILLIAMS: If the manager gives out word that the tickets are limited there is usually a tremendous scramble for those tickets.

MR. L. E. AVERILL (Safety Engineer, General Motors Corporation, Saginaw, Mich.): We put on a movie show in Saginaw during the hottest weather of the summer. There were 2,800 people in the auditorium and now they are asking: "When do we have another?" I am sure that the moving pictures shown by courtesy of the Michigan Mutual have helped us considerably in cutting down accidents.

MR. AL KROES (Director, Safety Educational Work, Employers Mutual Liability Insurance Company, Wausau, Wis.): We have given 1,047 shows last year, with a total attendance of 47,000. We have done this in theatres. We use about 75 per cent entertainment, with a good punch at the end. I think the tickets should be distributed among the families and then put on your posters, "For workingmen only." Then if you give him a ticket, he thinks he has something the other fellow hasn't. If you use posters have them large and glaring. Barnum and Bailey would never have made a success, if it had not been for posters. We all like to read them. They are exaggerated a bit perhaps and colored up, but they attract.

MR. M. K. AVERILL: I propose a resolution that the Automotive Section of the National Safety Council send letters of appreciation to every one of the speakers whom we have heard, complimenting them and thanking them for their kindness in giving us the benefit of their thought and for the trouble they have taken in bringing models, pictures, etc., to illustrate their talks.

(The motion was seconded and unanimously carried.)

STANDARDIZATION OF STATISTICS

GEORGE H. HAWES, SAFETY ENGINEER, MICHIGAN MUTUAL LIABILITY COMPANY, DETROIT, MICH.

It is a highly necessary function of a safety department to collect statistics on the causes, frequency, and severity of accidents. In other words, your statistics are the books of the safety department. Your accounting department keeps track of the cost of materials coming in from the plant, the cost of labor, cost of overhead, selling price, and profit. You have a safety department. You know what it costs. Why

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not find how much it is costing you per man in your plant to run that safety department? Find out whether or not it is making good. The only way you can find that out is to keep books; and these books should show you the causes of your accidents, frequency, and the severity.

From the employment department you must secure figures giving the number of work hours for each day. From the employment department and the plant hospital combined you must secure the number of accidents involving lost time, and the number of days lost because of these accidents. This information should then be tabulated on the following form which indicates the standard method for compiling accident frequency and severity rates:

ACCIDENT RECORD

	Period .....19.... to.....19....	Period .....19.... to.....19....
(1) Average number of employees.		
(2) Total number of hours actually worked by all employees.		
(3) Number of accidents causing lost time beyond day or shift during which injury was received.		
(4) Number of days lost because of accidents. (See note below.)		
(5) Frequency rate. Number of accidents per 1,000,000 hours worked.		
(6) Severity rate. Number of days lost per 1,000 hours worked.		

Note—If the above figures include accidents causing death or permanent disability, the severity of such accidents should be figured from the following table of equivalent days lost adopted by the International Association of Accident Boards and Commissions and the U. S. Department of Labor, Bureau of Labor Statistics.

SCALE OF TIME LOSSES FOR DEATHS AND PERMANENT DISABILITIES

Nature of Injury.	Degree of disability in percent of permanent total disability	Days lost
Death	100	6,000
Permanent total disability	100	6,000
Arm above elbow, dismemberment	75	4,500
Arm at, or below elbow, dismemberment	60	3,600
Hand, dismemberment	60	3,000
Thumb, any permanent disability of	10	600
Any one finger, any permanent disability of	5	300
Two fingers, any permanent disability of	12½	750
Three fingers, any permanent disabiltiy of	20	1,200
Four fingers, any permanent disability of	30	1,800
Thumb and one finger, any permanent disability of	20	1,200
Thumb and two fingers, any permanent disability of	25	1,500

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Thumb and three fingers, any permanent disability of	33⅓	2,000
Thumb and four fingers, any permanent disability of	40	2,400
Leg above knee, dismemberment	75	4,500
Leg at or below knee, dismemberment	50	3,000
Foot, dismemberment	40	2,400
Great toe, or any two or more toes, any permanent disability of	5	300
One toe, other than great toe, any permanent disability of	0	———
One eye, loss of sight	30	1,800
Both eyes, loss of sight	100	6,000
One ear, loss of hearing	10	600
Both ears, loss of hearing	50	3,000

(1) Injuries not involving amputation should be rated as a proportion of the weight assigned to the entire loss of the member involved, in accordance with the degree of impairment.

(2) The weighting for impairment of function of any member should be such percentage of the weighting for dismemberment as may be determined by the adjudicating authority in fixing the compensation for such impairment—i.e., if loss of an arm is compensated by 240 week's indemnity, then an impairment of the arm for which 160 week's compensation was paid, should rate as two-thirds of the loss of the arm in the above scale.

(3) Hernia should be included only as a temporary disability on the basis of the actual time lost.

Complete information on this whole subject is to be found in the Council's Safe Practices pamphlet No. 21 on "Accident Records" and in the U. S. Bureau of Labor Statistics Bulletin No. 276. I would urge every person here to get copies of these publications if you have not already done so, and to follow the suggestions which they present.

I have received reports from about 70 automotive manufacturers throughout the country. If there are any automotive men here who have not already reported to our statistical committee, of which I am chairman, I would appreciate it if you will get in touch with me so that we may include your reports also. We want to prepare for the Congress next year a very comprehensive report showing the accident frequency and severity rates of as many companies as possible. We also want to prepare a good classification by causes in order that we may determine which are our greatest hazards.

I move that the Automotive Section accept the standards of accident frequency and severity rates as indicated in the report form shown above, and that therefore members of the National Safety Council, especially the Automotive Section should adopt this system when computing accident figures.

(The motion was duly seconded, discussed, and passed unanimously.)

MR. KAEMS: Mr. Shaw has conducted our meetings in such a business-like way, it will be difficult for me to follow in his footsteps. Just one other thing comes to my mind. While this is the Automotive Section, there are many men in the metal business who are doing almost the same kind of work that the automobile people are doing. I think we should do something to make them feel that there is a place in this section for them too.

ADJOURNMENT.

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Chemical Section

September 27 and 28, 1921

IRA V. KEPNER, Chairman
Safety Director, Pennsylvania Salt Manufacturing Company, Philadelphia, Pa.

S. H. KERSHAW, Vice-Chairman
Fire and Accident Prevention Division, Hercules Powder Company, Wilmington, Del.

M. J. McDONOUGH, Secretary
Safety Engineer, E. I. du Pont de Nemours and Company, Philadelphia, Pa.

TUESDAY MORNING SESSION

IN the absence of Chairman Kepner, the meeting was called to order by Mr. S. H. Kershaw, vice-chairman of the section. Chairman Kepner's report, including mention of the activities of the various committees, was read by Mr. Kershaw and approved by the members present. The following men were appointed as members of the nominating committee: Mr. G. H. Scott, Mr. E. J. Riederer, and Mr. W. D. Keefer. Mr. Crass then read the following report of the Special Reports Committee:

SAFE PRACTICE IN HANDLING SULPHURIC ACID

M. F. CRASS, CHAIRMAN ACCIDENT COMMITTEE, THE GRASSELLI CHEMICAL COMPANY, CLEVELAND, OHIO

It is generally recognized among acid men that the venting or unloading of acid tanks is more safely accomplished by the blowing method than by any other. By the application of 30 pounds air pressure, acid can be lifted to a height of 40 feet, which is ample in most cases to discharge easily the contents of the tank car into an elevated storage tank. This method is economical for it entails little expense other than the maintenance of a small air compressor. On the other hand, if the tank car is

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equipped with a bottom outlet, it is necessary (unless your loading track is elevated) to discharge the consignment by means of an acid pump—a more expensive proceeding, for the maintenance expense of an acid pump is considerable.

TANK CAR BOTTOM OUTLETS

The greater the simplicity of any chemical apparatus, the more desirable it is, provided efficiency is not sacrificed.

Colonel Dunn, Chairman of the Bureau of Explosives, in a recent article strongly emphasized the fact that the breakage of the outlet connection frequently follows a derailment and adds considerably to the property damage and loss.

Bottom outlets are subject to considerable wear and tear and the threads of the collar which holds the plug or outlet cock are weakened by action of the acid. If bottom outlets were necessary for the discharge of the tank car consignments, they might be considered a hazard incident to the use of such equipment. This, however, is not the case. Experience has shown that the safest and most convenient method of discharging tank cars—that of discharging by means of compressed air—leaves no room for doubt as to the type of equipment or method which should be used in discharging acid from tank cars.

AMOUNT OF ACID LOADED IN TANK CARS

This is an important matter, the danger of which is not always appreciated. Variations in atmospheric temperature, especially in hot summer periods, tend to increase the volume of the acid through expansion. There is also further possibility of generation of hydrogen gas which directly concerns the amount of acid which should be loaded in the tank car because of the space which it takes up when present. The Bureau of Explosives covers this point in B. E. Pamphlet No. 9, paragraph 1825-A, wherein it is provided that the vacant space must not be less than 2 per cent of the total capacity of tank, including the dome and shell capacity combined. If the dome of the tank car does not provide this 2 per cent, sufficient vacant space must be left in the shell of tank to make up the difference.

If we consider 60-degree sulphuric acid as a base for calculation, the coefficient of expansion from 60 degrees F. to 110 degrees F. is 1.56 per cent. This, therefore, makes an actual increase in volume of 100,000 pounds of acid loaded in a tank car, equivalent to 1,560 pounds. Inasmuch as the ordinary dome has a capacity of approximately 700 pounds of acid, the possible overflow is apparent where proper provision has not been made for this expansion. It will be noted that the coefficient provided by the Bureau's specification provides a margin of safety of approximately 30 per cent.

The safety of the tank itself is not considered, as the added pressure is taken care of by the frangible lead disc in air pipe provided by A. R. A. regulations.

In discharging tank cars, great care should be exercised in making

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air and acid discharge connections. Many accidents have been caused through the spraying of acid from imperfect connections.

When the unloading of the tank is completed, the operator must see to it that the pressure on the tank is entirely relieved, by uncoupling the air cock first and opening the acid discharge connection last. If this operation is reversed, there is danger of the operator being burned.

Attention is called to another danger which is frequently encountered. Sales orders calling for definite tonnages sometimes result in the shipment of tank cars only partially filled. Furthermore, tank cars are sometimes supplied for loading when there may be insufficient stock to fill the tank. The result is an undue strain on the tank and tank car equipment due to swishing back and forth of the load, thus jeopardizing the safety of the heads and having a tendency to break the tank loose from its anchorage and possibly shift it on the car body.

TANK CAR LOADING RACKS

The rounding surface of a tank car makes a very insecure footing for workmen engaged in removing and replacing dome covers, connecting and disconnecting air lines, etc. Various acids and oils make a slippery footing when spillage is present; weather conditions—frost, snow, etc.—add to the difficulty. Various schemes have been devised to protect the operators in the course of this work, detailed explanations of which have been given in various journals, one appearing in the October 11, 1920, issue of the *National Safety News*. Properly constructed loading racks, by facilitating quick access to control valves, should entirely prevent the overfilling of tank cars, a point not to be overlooked or underestimated.

ACID LINES

It may be supposed that overhead lines supported on plank runways constitute a source of danger from possible leakage. This is not actually the case, for overhead lines on account of their exposed position, can be periodically inspected and incipient weaknesses corrected. Whereas, in a buried line, a leak is not apparent until the loss is sufficient either to saturate the ground or vent itself from the conduit in which it may be enclosed. Outside corrosion shortens the life of a buried line, while an overhead line can be kept painted and corrosion from the outside reduced to a minimum. Open flame lights should never be used while repairs are being made to acid lines, pumps, etc., on account of the possible presence of explosive gas.

GAS IN TANK

Hydrogen gas is often generated by the action of the sulphuric acid on the metal body of the tank. This gas is highly explosive when ignited and for this reason no light except a storage battery hand lamp or electric torch should be used around acid tanks.

WASHING OUT TANK AFTER EMPTYING

After a tank has been emptied, no one should be allowed to go into it until it has been completely filled with water and then emptied.

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Repeated fillings may be necessary, until the sediment of the tank is well dissipated, otherwise the gas liberated during removal of sediment may result in injury to workman.

BRIDGE TO TANK DOME

Numerous accidents have been caused by slipping and falling from the top of tank cars, particularly in wet and freezing weather, and to avoid this it is recommended that a pivoted swinging bridge be installed; a semaphore or some other signal should be provided to give warning that the car should not be moved while men are working on it.

METHOD TO BE FOLLOWED IN UNLOADING ACID FROM TANK CARS

1. Clean out sediment at bottom of acid discharge pipe by pushing down a ½ inch pipe with disc on bottom about ¼ inch smaller in diameter than discharge pipe.
2. Connect up acid discharge pipe and see that gasket is tight.
3. Connect up air pipe and see that gasket is tight.
4. Tighten up manhole plate, turn on air gently and see that manhole gasket is tight, also gasket of discharge pipe.
5. Gradually increase air pressure until acid discharges from tank.
6. Use least air pressure consistent with efficient work of unloading.

AIR PIPE EQUIPMENT

On platform place a safety valve on air line set to lowest efficient pressure. This valve to be kept locked and key to be held by Superintendent. Place globe valve on tank side of safety valve, to be closed when tank is emptied and before globe valve on air relief is opened. This is to protect safety valve from gas from tank.

ACID PLATFORM, BRIDGE, AND SEMAPHORE

A red semaphore should be placed over the acid unloading platform (connection directly to the bridge) so that it will be visible along railroad track in both directions, whenever a tank is being discharged or any one is working on or in the tank The semaphore will be over the track when bridge is down, and vertical when bridge is up. Hook on bridge when not in use.

CAUTION SIGNS

At each acid unloading platform the following list of DON'TS should be tacked up:

DON'T carry an open light around a tank car when filling or emptying same.

DON'T strike a match or smoke around a tank car.

DON'T use *any* light except an *electric torch* near or in a tank car.

DON'T fail to see that all gaskets are tight when turning on air pressure.

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DON'T fail to open air relief valve before disconnecting acid discharge line.

DON'T use excessive air pressure on tank.

DON'T go into an empty tank after unloading until after it has been completely filled with water and then emptied.

DON'T turn any tank car over to railroad company until you have seen that *all* gaskets are tight.

DON'T take any chances—SAFETY FIRST.

CHAIRMAN KERSHAW: Gentlemen, we are greatly indebted to Mr. Crass and his committee for the excellent work they have done.

(Chairman Kershaw drew on the blackboard a sketch of a tank car unloading platform and gave explanation of same.)

I would like you gentlemen to criticise this type of platform. We have had two or three men pretty badly burned, and it is a very difficult problem to solve.

MR. CRASS: There are two types of bridges; one is hinged to swing up and down in a vertical plane, the other is pivoted to swing sideways in a horizontal plane. They both cover the same end so far as loading the tank is concerned.

MR. G. H. SCOTT (Virginia-Carolina Chemical Co., Richmond, Va.): There is this objection to the vertical swing; if the car is moved when the platform is down, the car may wreck the platform.

CHAIRMAN KERSHAW: That is true, but we rather felt that was one thing that would have to be left to the diligence of the plant men.

MR. SCOTT: Did you figure on having the counterweight more than counterbalance the bridge?

CHAIRMAN KERSHAW: Just slightly.

MR. CRASS: If you have about two pounds difference on the bridge it couldn't fly up of its own accord and you wouldn't have to anchor it down.

CHAIRMAN KERSHAW: There is one feature I haven't shown; a little bracket that slides up and down here to support the platform and take the strain off of the main structure.

MR. CRASS: To prevent the unexpected moving of cars at the loading platform, I am considering the use of derailers. The derailers would be placed by the tank car filler and he would not remove them until the work was completed and the dome cover screwed down.

MR. KING: I move that we accept and approve Mr. Crass' report on "Safe Practice in Handling Sulphuric Acid."

(The motion was seconded and carried.)

PORTABLE ELECTRIC LANTERNS

CHAIRMAN KERSHAW: I spoke last year about efforts I was making to secure a portable electric hand lantern of the storage battery type. This could be used as a substitute for portable extension lamps. I might cite the fact that two or three companies have had very disastrous explosions resulting from the use of extension cords. I corresponded with the Edison Storage Battery Company, not as an officer of the Chemical Sec-

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tion, but for our company, to find out whether or not they would be interested in making up storage battery hand lanterns. They replied unfavorably, but referred me to a company in Dayton, Ohio, to whom I will write at a later date.

The use of two lamps on opposite sides of a hand lantern would give general illumination, which is one of the objections to using the ordinary portable hand flashlight. The idea is not original with me. I happened to see such a lantern illustrated in a German book wholly devoted to the subject of safety, and they have evidently developed a lamp of that kind and are using it.

MR. CRASS: Some plants do not have facilities for washing or steaming tanks to remove the fumes and small quantity of acid, so I think it would be fine if a lantern such as you describe could be developed.

MR. V. C. KING (Wickwire Spencer Steel Corporation, Worcester, Mass.): I think there are other possibilities for a lamp of that type aside from its use in acid tanks. The hazard from explosion in oil tanks is fully as great as in acid tanks, or greater. We, therefore, should not confine the discussion to acid tanks entirely.

MR. S. E. WHITING (Liberty Mutual Insurance Company, Boston): This type of battery lamp would eliminate the electrical shock hazard of extension cords. Of course, the voltage used with extension cords is low, but to my personal knowledge there have been four or five fatalities from low voltage shocks, two of them in chemical plants, although the men were not in tanks at the time. When a man is in a tank he is unusually well grounded, no matter what the contents of the tank may be, and at some point in the circuit he is using for his light there is apt to be a connection to the ground. They often have a 3 wire 220 volt circuit with a permanently grounded neutral, so if he makes a good contact with the line through the defective lamp cord, he is apt to get a very severe shock, which may prove fatal. I know of another case where an extension cord was dropped into a tank containing solvent. No one was in the tank but a man standing nearby was killed by the explosion which followed. I think you are suggesting a very desirable practice to use self-contained portable electric lanterns and hope that you can get someone to develop them into a good practical shape. I am rather surprised that the Edison Company didn't wish to consider this proposition because they have already developed such a lamp for miners to decrease the danger of igniting mine gases.

MR. KING: Many men jump when they receive a slight electric shock and in so doing might drop tools or cause things to be spilled which in falling may injure nearby workmen.

MR. E. J. RIEDERER (Atlas Powder Company, Wilmington, Del.): I move that this whole subject be referred to our special reports committee with the request that they communicate with lamp manufacturers and attempt to secure their active co-operation in developing a light such as we have been discussing.

(The motion was seconded and carried.)

CHAIRMAN KERSHAW: I have heard of a power plant where the hazard

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of 110 volt extension lamps used in boilers was recognized, and they went to the trouble and expense of installing small stepdown transformers in their boiler rooms and using 28 volt circuits for all portable extension cords.

FUMES

DR. C. F. N. SCHRAM (Fairbanks, Morse Company, Beloit, Wis.): What effect do the fumes of nitric and sulphuric acid and ammonia have upon the men who breathe those fumes?

MR. CRASS: As to sulphuric acid, ordinarily SO_2 fumes are not deleterious to health unless long continued. I have been in SO_2 gas many many times, and the best way is to take a handkerchief, wet it and tie it over the nose and mouth. The danger comes from HNO_3. As regards ammonia, that would be a carbon monoxide proposition, CO, and that is of course always very dangerous. If there is any CO escaping the best thing for a man to do is to get out as fast as he can and let the apparatus go. Where we have any danger of CO gas we furnish our men with gas masks with cannisters specially designed to take up and neutralize CO gas. We have another mask which will take nitric vapors, sulphuric vapors, HCl vapors, all with the same canister.

DR. SCHRAM: If a man is working in mild acid fumes, how long can he stay in that sort of employment? Does he ultimately develop a chronic bronchitis or tuberculosis? Do you have to change him out of that work shortly?

MR. CRASS: On general principles no man should be allowed to continue in employment where he is constantly exposed to gas. There is only one exception to that—that is sulphur dioxide gas which is thrown off in steel mills and pickling plants. It is rather obnoxious but it is not dangerous. A man can work in that a long time. If a man is working in a place where there is every day occasion for him to breathe gas for a while, especially fumes from nitric acid, I wouldn't allow him to stay there too long; a change of employment is highly desirable. He couldn't develop tuberculosis. I think that chemical plant men are about as free from tuberculosis as the men of any industry that I know of.

MR. RIEDERER: Perhaps Mr. Crass doesn't mean that everyone working in nitric acid should be changed; workmen should be changed, however, when exposed to the low oxides of nitrogen. Such fumes are usually reddish brown in color and are very dangerous, often causing death.

CHAIRMAN KERSHAW: The following are three of the leading authorities on industrial poisons: Kober and Hanson, Thompson, and Rambousek. You will find that their treatises on industrial poisoning cover this subject very fully.

MR. CRASS: I am glad that Mr. Riederer pointed out the difference between the fumes from ordinary nitric acid and those from low oxides. I might add one thing. If you have a case where a man has been exposed to lower oxides, whether he feels bad or not, send him to a physician immediately.

CHAIRMAN KERSHAW: The next topic for discussion is the general handling of caustics.

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MR. A. L. WATSON (Hooker Electro Chemical Company, Niagara Falls, N. Y.): The company that I represent sells both ground and solid caustic. There is some demand for ground caustic but there seem to be many places where caustic in the lump form only can be used; why this is so, I do not know. Our men who grind caustic are provided with canvas hoods that cover their entire heads. After a hood is used a short time it will get mussy and we provide our men with new hoods from time to time. These hoods have glasses in the front, set in aluminum frames; sewed to the canvas. We don't supply air to these helmets but do to a similar helmet used where bleaching powder is made. Our men wear rubber boots or rubber shoes with canvas leggings and buckskin mits, and in some places where the men actually have to pick up caustic, they are provided with rubber gloves.

We have located in various places throughout our caustic department bottles containing a solution of zinc sulphate. These bottles are inspected daily. That is the only treatment we have for immediate first-aid in case of caustic burns. Any man receiving a caustic burn is immediately treated with zinc sulphate, a doctor is notified, and the man then taken to the hospital, where the burn is washed again with zinc sulphate and also with an oil. There are several kinds of oil that are good. We use olive oil for serious burns. We have some trouble with hot caustic burns especially in the eye.

MR. RIEDERER: Would a 5 per cent carbolated-olive-oil solution be of any value. This has been recommended by physicians.

The 5 per cent carbolic acid prevents the olive oil from getting rancid.

CHAIRMAN KERSHAW: Another company I know uses a 3 per cent solution of acetic acid for the first-aid treatment of caustic eye burns.

MR. R. E. VANATTA (Pittsburgh Plate Glass Company, Barberton, Ohio): We use acetic acid. We have several nurses who care for our men who get caustic in their eyes. They use a hot acid solution from five to seven times a day and then apply castor oil.

MR. J. R. MAC MILLAN (Niagara Alkali Company, Niagara Falls, N. Y.): I had a severe caustic burn myself one time and kept it flushed for an hour or two with boric acid solution and found it cured very rapidly. In our plant we use acetic acid—about 2½ to 3 per cent—for body burns, and about ½ per cent for eye burns. The more frequently body burns are flushed out and the harder they are rubbed, to rub away the tissue that has been attacked, the quicker they will heal up.

CHAIRMAN KERSHAW: I understand that heavy scab formations puzzle the doctors.

MR. VANATTA: We just pull the scabs off.

MRS. M. T. HAWKINS (National Enameling and Stamping Company, Baltimore): Do you keep on using acetic acid or do you change afterwards to boric acid?

MR. MAC MILLAN: We change afterwards to boric acid and olive oil or castor oil.

MR. A. G. SMITH (Travelers Insurance Company, Hartford): I know some companies that use acetic acid plus about one-half per cent of

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iodine for body burns. For eye burns the boric acid (about 2 per cent solution) seems to be quite generally used.

CHAIRMAN KERSHAW: Referring to methods of unloading drums of caustic, I have heard of companies who have rigged up a dissolving tank, probably rectangular, and put a frame across the top. They take the lid off of the drum, invert it, and set it up on top of this frame; a pipe line running up underneath squirts water into the drum until all of the caustic is dissolved. A pump keeps the water circulated. I think some people have even put the caustic in bags and immersed them in a solution.

Some companies rip open the drums and break the caustic with a mallet, axe, or hatchet. The broken particles have a tendency to fly. It seems to me I heard of one organization where they put a heating element around an enclosure into which the drums are placed. The caustic runs out as it is melted. Whether that has been worked out successfully or not I don't know.

MR. C. E. SEVRENS (Merrimac Chemical Company, Boston): Our men use heavy hammers and by continual pounding they break the caustic; by the time the drum gives away the caustic is well broken. We have done that for some time and as yet no men have been burned. At times we get some grades of caustic that won't break as easily as other grades.

MR. SMITH: I have seen men remove the top of a drum of caustic, and using a wood auger they bore a hole in the center of the caustic. They then insert a steam pipe and allow the caustic when it is melted to drop down through an improvised platform into the solution kettle.

GENERAL DISCUSSION

CHAIRMAN KERSHAW: If there is no further discussion on this subject the meeting is open for any subject any of you gentlemen may wish to bring up.

MRS. HAWKINS: In our pickling room in Baltimore the men's teeth all seem to be affected in some way or other, whether it is from the fumes or what, I don't know. I would like to get a little information on that subject if possible.

MR. CRASS: I can't answer with reference to the effect of the acid vapor upon the teeth, but it isn't necessary to have acid vapor in any quantity. There are preparations on the market that will form a foam over the pickling tank and keep the pickling room practically free from acid vapor.

MRS. HAWKINS: Does chewing tobacco help prevent the action of acid fumes on the teeth?

MR. RIEDERER: Many men have pyorrhea which is not due to inhaling acid fumes. I don't believe tobacco has any effect either beneficial or detrimental. It is considered a good idea to wash out the mouth once or twice a day with a solution of bi-carbonate of soda, preferably before eating meals.

ADJOURNMENT.

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WEDNESDAY MORNING SESSION

THE second session was called to order by Chairman Kershaw. In the absence of Mr. Shaw, his paper was read by Mr. G. H. Scott, Virginia-Carolina Chemical Company, Richmond, Va.

PROTECTION FROM EXCESS PRESSURES IN CHEMICAL APPARATUS

J. S. SHAW, ASSISTANT TO GENERAL MANAGER, HERCULES POWDER CO., WILMINGTON, DEL.

The general principles or rules applied to the safeguarding of machinery do not suffice when considering excess pressures in chemical apparatus, for in handling chemicals each safeguard must be separately and specifically designed to meet the peculiar requirements for which it is intended. This is because of the numerous properties of chemicals and the changes constantly taking place between them. General safety rules are often of little use and are frequently positively dangerous if literally applied; for instance, as a general rule, we would use water for fighting fire but a fire involving metallic sodium might be intensified by the application of water.

Let us consider the factors governing excess pressures in chemical apparatus. They are:

1—Heat (Natural and Artificial)
2—Chemical Reactions
3—Design of Apparatus
4—Control, Maintenance and Inspection

HEAT

Natural Heat. There are many volatile liquids, both flammable and non-flammable, which are handled and stored in various containers and innumerable forms of chemical apparatus, and proper study must be given to each compound or element regarding its chemical and physical properties.

The effect of the sun's rays in generating heat and pressure is in general the same but the risks set up are varied and the specifications for safety when handling chemicals necessarily differ.

The Interstate Commerce Commission has done the country and industry a wonderful service in developing intelligent regulations for the safe handling of chemical compounds, and we cannot emphasize too strongly the need of strict observance of the regulations laid down by this creditable organization. As a special reference, see their pamphlet No. 9. The regulations of this Commission should be equally safe for chemical factory practice.

The Standard Tank Car Company (works at Sharon, Pa.) have also issued a splendid publication entitled, "All About Tank Cars". This

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handbook contains the requirements of the American Railway Association and may be obtained from the Standard Tank Car Company's New York office, situated in the Woolworth Building.

The variation in temperature and pressure due to climatic changes is serious. A tank car of ammonia liquor contains non-flammable but volatile material and when shipped from Milwaukee across the deserts to the southwest may undergo a change of 50° to 60° F. in the sun. Pressure changes take place in shipments like this and care of the safety vents, piping, and the degree of filling the car must be taken to see that proper provision is made for maximum pressure. Drums of ether, carbon-bisulphide and various light petroleum products and other dangerous flammables are sometimes shipped and stored with little regard for proper shelter from the sun's rays. It is impracticable to equip drums with safety valves and hence a greater likelihood of excessive pressure when these containers are exposed to sunlight. Carbon bi-sulphide, for instance, is highly flammable and ignites from little friction at fairly low temperatures. Greatest precaution should be taken to store such compounds in cool and sheltered places. But what foreman would ordinarily think of this if not properly guided?

A safe practice, I believe, is to have the factory's laboratory advised of the expected arrival of not only flammable liquids, but all materials such as compressed gases, metallic sodium, quicklime, etc., as the chemist in charge should make the proper recommendations for handling and storing all chemicals.

Artificial Heat. The subject of excess pressures from artificial heat sources takes in operation and control and will be discussed later.

CHEMICAL REACTIONS

Heat and pressure are usually developed when different chemical compounds are mixed together. For this reason, general rules often fail when we adhere to them too literally.

We are taught to fight fire usually with water, but there are many instances wherein excess pressures, fires, and even explosions may occur if water is used. Hence the importance of having proper equipment for fighting fires occurring between specific chemicals, and the absolute necessity for not placing them adjacent to one another where trouble might occur if they should come together through leaky or faulty equipment. As an illustration, we would not store drums of glycerin near a mixed acid pipe line; glycerin, in this case, being only one of hundreds of substances which would be dangerous when coming into contact with mixed acid. Neither would we transport through a common pipe line or ones which are cross-connected or joined by manifolds, chemicals which react upon each other.

DESIGN OF APPARATUS

It has often been said that "necessity is the mother of invention", but I believe that in ninety cases out of one hundred, accident is the mother of invention, because many improvements grow out of accidents;

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so the design is based largely upon accidents and the lessons they teach.

Consideration should be given to the strength of materials at maximum possible pressures and the risk to life, as well as surrounding buildings and equipment. The American Society of Chemical Engineers has done very good work along this line and there are many standard references on the subject.

When it is not economical to design apparatus to withstand maximum pressures, proper safeguards should be provided. These may be safety valves, vents, discs, pressure gauges, thermometers, pressure regulating valves, or alarms. In many processes excess pressures are controlled by proper agitation, cooling, and refrigeration.

In planning the layout of a plant, proper distances between apparatus should be maintained and when such are impracticable, ample barricades or shelters should be provided. Some dangerous operations should be spread out in separate buildings and even then in certain cases it is found necessary to barricade the buildings, or to separate them by screens or fire walls.

All apparatus should be provided, as far as possible, with natural light and should be readily accessible both to the operator and repair man, for nothing is more conducive to neglect of the equipment than is remote location. If control valves cannot be reached easily, extension handles or pull chains should be installed.

Next come the connecting links between various operations and their apparatus. They are usually pipe lines, conveyors, gutters, troughs, or cars. In general, interlocking pipe lines with complicated valve arrangement should be avoided. The same may be said of troughs, gutters, or car lines. A switch and signal system in the last case would correspond to a complicated valve arrangement in a pipe line. Where it is necessary to parallel pipe lines used to convey dissimilar liquids and gases, distinctive and standardized colors or markings should be given each line. To further avoid confusion and error, the use of semaphores and pointers for day work and signal lights for night, have been found helpful. These are usually more reliable than telephonic control, since the eye is less apt to err than the ear.

All signals and indicators, including pressure gauges, thermometers, pyrometers, monometers, etc., should be well illuminated and easily accessible for good maintenance, as well as for safe operation. Whenever it is imperative that indicators be placed in remote places, the use of periscopic mirrors and telescopes has met with success.

The design should include a complete study of centralized and automatic temperature and pressure control, since automatic equipment is generally more accurate and safer than the human element, provided the operator will keep the automatic equipment in perfect order. It is easier to keep automatic equipment in good working order than it is to operate without it, using only manual control.

The boiling points of liquids must be considered. For instance, in a closed system, such as an ammonia absorption refrigeration system, where the boiling ammonia liquor generates a pressure in excess of the

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steam pressure of the heating coils, the design should permit easy control of the steam valves governed by accurate and visible pressure gauges to indicate actual pressure in the absorption apparatus.

CONTROL, MAINTENANCE AND INSPECTION OF APPARATUS

Control. We have recommended centralized and automatic control. Not all designs can have both, but many may have one or the other, thus eliminating much error and risk; and if both automatic and centralized control can be combined in one, we have almost an ideal condition. Many mistakes are made by depending too much upon automatic control. We must remember that everything fails or wears out in time and that automatic safeguards, such as pressure gauges, regulating valves, and thermostatic equipment with signal lights and alarms, are far more accurate than man, but they must be kept in good order. To do this, the operator must keep such equipment under his constant observation.

Without automatic safeguards, an operator may attempt to regulate steam pressure by a hand valve, but variations in the boiler load elsewhere in the plant may suddenly change the main line pressure. If the change is upward, excess pressures might arise and do much damage to apparatus and product, to say nothing of the risk to life and property.

We have had experience in distillation operations where the temperature of the product as distilled was haphazardly observed by the operator, using an ordinary thermometer, in each gas offtake of the retorts. Often excess temperatures caused severe "capers" and "blows" with disastrous results to the workmen, product, and apparatus. After two years of experimenting, an automatic recording pyrometer, which withstood the chemical action, was completed and installed. There was centralized control and one workman was enabled to notify all other operators in advance of approaching high temperatures so that excess pressures were avoided and smooth distillations, with much less wear and tear in the apparatus, together with a 30 per cent reduction in fuel, resulted.

The appliance was automatic to the extent that temperatures in all retorts were recorded every few minutes and a chart plotted, but it required the human brain to read and interpret those records so that the operators could be guided accordingly.

Of course the first cost of installation is often the tide against which the safety engineer has to paddle, but experience generally proves that the more automatic and centralized the control in chemical industry, the more economical is the operation in the long run. Fewer accidents, lower maintenance cost, and fewer spills are really larger items. The first cost of installation is often saved by preventing a few personal injuries, damage to equipment, and losses to product.

We should not leave the subject of control without due regard for the great importance of good housekeeping and without reference to the human element. When we picture a dingy, dark, ill lighted, and poorly ventilated factory, such as we often see, is there any wonder that there are accidents? Accidents are a direct reaction of ill health and poor training, resulting in general indifference, or excess pressure set up in the chemical factory's nervous system—the workers.

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Intelligent and well trained workers who enjoy healthful and cheerful working conditions, well lighted and ventilated buildings with interiors painted white, floors that drain, and apparatus that is tight and safe, are a great asset to the chemical manufacturer and should receive as much consideration as any other economic phase of his business.

In visiting many factories I have found those having fewest injuries, without any exception, to be those which are the neatest. The great moral effect upon the workers, and the management as well, is an investment that pays handsomely.

Maintenance and Inspection. Accidents resulting from pressures in excess of the strength of the apparatus often are caused by a lack of proper maintenance of the equipment, but are probably more often caused by lack of proper maintenance of the safety and control instruments.

It is difficult to separate inspection from any part of this plan, for inspection extends throughout all stages from designing and building to operating and maintaining the plant. Human acts should be based upon observation—the underlying principle of man's senses.

The plant manager is the chief inspector of the organization and although his obligation is great, the obligation of the safety engineer is relatively as important.

Regular systematic inspections of all apparatus by a competent and experienced operator, selected especially for this work, should be made. He should be a man capable of teaching other operators and inspiring them to co-operate by developing their interest so that they will make useful suggestions. Thus each worker in a measure would become a safety worker and not depend too much upon the safety engineer. On the contrary, the safety engineer must rely more upon the workers for the safe operation of the plant. By true and sincere effort on the safety engineer's part, and through freedom of suggestion and expression extended to the workers, a great advance in industry has been made in the past few years.

Records should be kept of the cost and life of various equipment and of control instruments; and all future designs and replacements should be improved according to the experience recorded.

There are many types of safety valves, safety discs, vents, etc., on the market and the safety engineer should satisfy himself that the appliances adopted by his employer are the best adapted, most durable and safest for the particular requirements for which they are intended.

CHAIRMAN KERSHAW: Centralized control of hazardous apparatus is particularly important. Suppose, for instance, the railroad companies were to use locomotives that had the throttle at one end, the brake lever at the other, the pressure gauge here, and some of the other appliances scattered all over the locomotive, wouldn't is be logical to expect accidents about every other day on the railroads? It seems to me that that same thing applies to a good many chemical plants. We find nitraters and similar apparatus controlled by valves and cocks located here, there, and the other place, so that the operator has to jump from one place to another; is it any wonder that mistakes are sometimes made?

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I would call your attention particularly to the hazard of blow cases (acid eggs, or montejus). At first thought, it seems that the factor of safety used in designing steel blow cases should be considerably higher than for air receivers. We wrote questionnaires, however, to all of our plants and asked for their experience with their oldest blow cases—some 15 to 18 years of age. A summary of their replies indicated that there is not so much danger of the blow case giving away all at once (in fact, we have no records of explosions) but that corrosion thins the sheet at certain points and allows the air to escape gradually, probably carrying some acid with it.

MR. SCOTT: I never heard of an acid egg blowing up in my life.

CHAIRMAN KERSHAW: I have heard of the lid of a cast iron acid egg letting go with a man standing on top of it.

MR. SCOTT: Wasn't that due to corrosion?

CHAIRMAN KERSHAW: It was a cast iron acid egg, and the bolts, I think, were corroded out and the whole cover lifted.

MR. SCOTT: Don't you think that that danger could be very largely eliminated by abandoning as far as possible the acid egg and going in for the air lift?

MR. RIEDERER: I do not believe that the blow case can be eliminated. There are frequent cases were you would blow to an elevation of 60 to 100 feet or more. If you had an air lift it would mean a successive number of air lifts because your boot would be about 50 to 60 per cent of the elevation. Consequently, it would make a very difficult and expensive installation. One thing of vital importance is to use no cast iron on the acid egg which comes in contact with the mixed acid (sulphuric and nitric).

Mixed acid rapidly attacks cast iron making it porous, brittle, and dangerous. All plates, nozzles, valves, and connections which come in direct contact with mixed acids should be of steel, cast or malleable.

(Chairman Kershaw drew a sketch on the blackboard and proceeded to explain it.)

CHAIRMAN KERSHAW: This shows a section through a casting which is recommended by the American Railway Association for use as a standard safety disc, that is a frangible disc. We often use the safety disc for protection, because safety valves corrode and fail when exposed to certain chemicals. What material is best for making the disc is a question. Monometal, aluminum, or perhaps lead, can be used in many cases.

MR. SMITH: The National Aniline and Chemical Company plant in Brooklyn is experimenting with different metals and may in several months have some valuable information to divulge.

In addition to discs special types of safety valves have been designed to relieve excessive pressures on chemical apparatus. (Mr. Smith made a sketch on the blackboard and proceeded to explain it.) This shows a reservoir attached to an ordinary standard safety valve. To that safety valve is attached a nipple which runs down into the reservoir which contains oil. The pressure from the autoclave will force the oil through this nipple to the seat of the valve, maintaining pressure which is in

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the autoclave, but this oil seal will prevent the gases from coming in contact with the valve seat. Consequently there is not as much probability of the valve seating as there would be if the gases were against the valve seat continually. I have seen that valve used on pressures up to 1,500 pounds and it has worked quite efficiently. The main objection to it, however, is that it is necessary to fill the reservoir with oil each time the valve blows. Perhaps an auxiliary reservoir can be arranged to supply oil automatically each time the valve blows.

CHAIRMAN KERSHAW: That is a real idea. Are there any cases in which the use of oil in contact with the gases or chemicals in autoclaves would be hazardous? For instance, if used on a mixed acid apparatus the mixed acid might get over and nitrate the oil. That would be a hazard.

MR. SMITH: You would have to use some discretion as to the adaptability of that valve to different chemical mixtures. Sometimes autoclave valves do not function because of the leakage of the valve; that is one thing that different manufacturers are desirous of overcoming.

CHAIRMAN KERSHAW: I was in a plant some time ago making an inspection, and found a storage tank used as a blow case. The tank was about eight by twenty feet. On checking up, I found that the pressure regulating valve was out of order so that nearly every time they blew the acid from the tank there was danger of getting 55 pounds of air pressure. I took it up with the plant engineer. The tank looked rather weak and in going over it together we estimated that with 55 pounds pressure in the tank the margin of safety was about 1. This merely illustrates the point that great care must be exercised to prevent the use of air at a pressure greater than actually required.

We now expect to provide sealed cabinets around our valves which regulate the pressure to the blow cases. These cabinets may be locked and keys given only to the master mechanic and the plant engineer. If these valves are not locked the men are tempted to readjust the valves and put more pressure in the tanks; serious explosions may then follow.

I will now ask for the report of the nominating committee.

REPORT OF NOMINATING COMMITTEE

MR. SCOTT: Your committee considered the geographical location of the various men under consideration, knowing that if they are able to get together from time to time, the Council will be better served. We therefore nominate Mr. S. H. Kershaw as chairman, Mr. E. J. Riederer as vice-chairman, and Mr. M. J. McDonough as secretary.

MR. K. R. BURKE (American Tar Products Company, Chicago): I move that a unanimous ballot be cast for the men thus nominated.

(The motion was seconded and passed.)

CHAIRMAN KERSHAW: I will instruct the secretary to cast the ballot. For the chairmen of committees for the coming year, I will appoint Mr. M. F. Crass again as chairman of the Special Reports Committee; Mr. W. D. Keefer as chairman of the Bulletin Committee; Mr. I. V. Kepner as chairman of the Membership Committee, and Mr. L. A. DeBlois

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as chairman of the Program Committee. Those gentlemen will appoint their respective committees.

(Mr. Kershaw briefly acknowledged the honor of being elected chairman of the Chemical Section and asked for the active and critical support of the members. He then spoke of the work that he had already done toward securing a working agreement between the Chemical Section of the National Safety Council and any one of the following three organizations: the American Chemical Society, the Manufacturing Chemists' Association, and the American Institute of Chemical Engineers. It was then decided to turn over the whole proposition to a special committee to be appointed at a later date. Mr. Crass next read the following two reports of the Special Reports Committee.)

ACCIDENT HAZARDS IN OPERATING FILTER PRESSES

M. F. Crass, Chairman Accident Committee, The Grasselli Chemical Company, Cleveland, Ohio

The old-time filter press, as a usual thing, was equipped with a capstan, screw, and bar for tightening and loosening plates. Operating this press was a very arduous job, especially in the final winding up of the press and tightening the plates, and it frequently became necessary for the operators to apply extension bars on the capstan bar in order to get sufficient leverage or pressure to tighten the press up to the desired point. Accidents have been caused by this auxiliary bar slipping. There also have been instances of men standing on the bars in order to get added pressure or weight to bear on same, which practice has resulted in falls with more or less serious injury to the workmen. Severe strains also have resulted from the excessive effort required, with its promotion of hernia and other like strain results. In order to avoid the evils attendant upon the operation of this old-style press, other types of presses have been designed.

HAND OPERATED PRESSES

Hand operated presses may be of the direct drive or gear drive types. Either type may be operated in three different ways: by

(a) Removable bar and capstan
(b) Fixed bar in ratchet
(c) Hand wheel

Removable bar and capstan is the oldest type. It has the advantage of low first cost and is satisfactory for low pressure filters. It also has the least number of wearing parts. Its disadvantage is that its operation places heavy strain on operators except for the lowest pressures.

Fixed bar in ratchet operation is an improvement and can be installed on the old type presses. The advantage is that it keeps the bar in the most advantageous position for operation at all times. The chief disadvantage is that the ratchet occasionally fails to catch when the cogs are worn and allows the men to slip or fall. This, however, can be avoided by careful inspection.

Hand wheel operation is easier and safer to operate than the capstan

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bar, is probably faster in operation, and can be operated without a man throwing himself off his balance. It, however, does not provide the leverage necessary for tightening up presses of the larger type.

A gear drive requires less effort for obtaining the necessary pressure on plates and so decreases the strain on the men and also lessens the chances of slipping and falling. It, however, is slow in operation and costs nearly as much to install as the hydraulic press.

A study of the various methods employed in operating the hand-operated press leads one to the conclusion that a gear drive operated by as large a hand wheel as the distance between the shafting and the floor will permit, seems to be the best arrangement, as the gears can be made with such a ratio that they will more than compensate for the decrease in the leverage of the wheel over the bar. This type can be used where it is impossible to install or operate a hydraulic press. In no case, excepting for the very lightest press, should a filter press be operated with a bar.

HYDRAULIC PRESSES

Wherever it is possible to install this type press, it has undoubted advantages: it is faster in operation, and acidents are eliminated in connection with its operation. There are few detracting features and those who have used it have obtained satisfactory results in labor saving, general efficiency of operation, and maximum capacity. Where a high-powered or large size press is required the hydraulic press is the most satisfactory in the long run. Its only disadvantage lies in its first cost.

CENTRIFUGAL DRYERS OR EXTRACTORS

M. F. Crass, Chairman Accident Committee, The Grasselli Chemical Company, Cleveland, Ohio

Under no circumstances should a centrifugal dryer be operated without a suitable casing. Should the extractor ever give way, the casing should be strong enough to retain the broken pieces of metal which otherwise would fly out at terrific speed endangering the lives of nearby workmen. In some cases cast iron casings have been supplied. Cast iron shatters rather readily, especially under severe blows and for this reason its use is not recommended. Casings made of steel have a much higher tensile strength and will afford almost absolute security in case the basket breaks. It is estimated that the casing should be of ⅝ inch steel when the capacity of the basket is 100 to 200 pounds. The casing should have suitable openings so the basket can be inspected without being removed. If these casings are properly constructed an operator will be practically immune from danger providing the extractors are properly operated. No operator should be allowed to lean over baskets or attempt to level off the load in the basket after the power is thrown on and the basket put in motion.

A band brake and spring designed to apply the proper safe friction in stopping the basket should be installed on each centrifugal. These

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band brakes are adjustable but are equipped with locks so that operators cannot tamper with them and vary the amount of friction which can be applied. The adjustment of the brakes should be carefully supervised by responsible men.

It is our belief that these brake regulating devices and the safeguards thrown around their use are the secrets of exemption from accidents in connection with the operation of this apparatus. Further security can be had by following the practice of making daily inspections of each centrifugal. This should be done by some competent person in the department where the machines are used. These daily inspections should be checked up by monthly inspections by a competent engineer, at which time the inspection bars in the casings should be removed for the thorough inspection of the baskets.

MR. WATSON: I move that Mr. Crass's reports be accepted.

The motion was seconded and passed.

CHAIRMAN KERSHAW: Several years ago one of our centrifugals let go and flew into several hundred pieces; one man was crippled so that he hasn't recovered fully yet.

MR. SMITH: There was an explosion in New Jersey about six weeks ago in a silk manufacturing plant where four men were killed. The compensation costs will probably aggregate about $30,000; the property damage as yet has not been accurately estimated by the insurance adjusters. The cause of the explosion was attributed to the basket becoming corroded. It seems that the material they were putting into the extractors was impregnated with acid. The basket, however, was lined with rubber to prevent acid from corroding the copper basket; yet the rubber cracked and the acid leaking through this crack corroded and weakened the basket so that one day it ruptured while in operation; it broke the casing of the extractor and flew into a thousand pieces. If the casing had been made of cast steel probably no one would have been injured.

Another point of interest is the use of interlocking covers on extractors. Most of the manufacturers have interlocking devices so that the covers of the extractors cannot be raised while the machine is in operation. We occasionally get reports of accidents resulting from the operators endeavoring to shift the load in the basket while the basket is revolving.

The uneven loading of the extractor basket, or the shifting of a load in the basket while it is being operated cause many accidents. The uneven loading of the basket causes it to vibrate seriously, and if the vibration is such that it causes the foundation of the extractor to vibrate, that loosens the fastenings of the extractor, and if the operator is on his job he will slow down the machine and shift his load. There again, if the extractor doesn't have the cover locking device, he is apt to get his hands inside before the machine comes to a stop.

ROUND TABLE DISCUSSION

CHAIRMAN KERSHAW: During the past year we communicated with practically all of the member companies and asked for suggestions for

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subjects for discussion at this meeting, so I will read some of the suggestions that were returned and we will discuss them if you wish. "Prevention of and remedy for irritation of skin by copper dust"; "Gas Masks". There may be some new developments along that line we have not heard of. Dr. Lewis of the Massachusetts Institute of Technology gave a very interesting talk on and demonstration of gas masks at the 1919 Safety Congress.

"The best method of protection for mechanical workers doing repair work on equipment involving fume poisoning and burn hazards." A short time ago three or four of our men started to do some repair work inside an acid tank. They first disconnected the acid lines leading to the tank and inserted slip blanks of the frying-pan variety. Just as they had finished inserting the last slip blank the noon whistle blew, so they left the tank and went home to lunch. When they came back that afternoon they found the tank nearly full of acid. It was a lucky thing the whistle blew when it did because they had planned to go inside the tank as soon as the slip blanks had been inserted. Investigation showed that one blank had not been inserted properly and an open space had been left at the edge of the blank just large enough for acid to leak through. The men should have used a slip blank as large as the full diameter of the flange. If the blank has bolt holes it can be tightened in place and thus absolutely prevent leakage. We have made it an iron-bound rule with our company that no man shall enter a tank without taking out a section of the pipe line and blanking off the dead end.

MR. VANATTA: Caustic workers claim—and it is so—that perspiration collects around the eyes where the goggles come in contact with the skin. Caustic dust causes burns there and many men prefer to take a chance on getting caustic in the eyes rather than suffer from burns that otherwise are sure to result from wearing goggles.

CHAIRMAN KERSHAW: One of the member companies developed a muslin hood with a large glass in front for the man to wear over his entire face.

MR. VANATTA: We use hoods but many men object to them also. We use almost every kind of goggle obtainable.

CHAIRMAN KERSHAW: We use King-Brayton face masks to protect men against flashes.

MR. VANATTA: Our repair men are injured oftener than the men in our caustic department. We have not had what I call a real serious accident in the caustic department since I have been there—two years. But we have had four fatalities among the men in our repair gang. One man fell from a scaffold; one was killed in a railroad accident; a third man was killed on a 220 volt electrical current.

DR. ALICE HAMILTON (Harvard Medical School, Boston): Concerning your first question I have never found any literature discussing the irritating effect of copper dust upon the skin. Is that a copper smelting plant where there might be arsenic?

CHAIRMAN KERSHAW: I don't know; the question is from the Mountain Copper Company, California.

DR. HAMILTON: Is there any new information concerning the preven-

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tion of poisoning in cleaning and repairing benzole receptacles? That was taken up two years ago in a meeting of this section.

MR. CRASS: We are interested in that subject as are many other concerns in the aniline chemical field, by-product production. I think the very best treatise that has been issued comes from your own pen, Dr. Hamilton.

DR. HAMILTON: The only suggestion I have heard that seems to be of value is the procedure used by the Illinois Steel Company in their new by-products plant. They specify that before a man is sent into a benzole tank, a mouse shall be lowered into it first. The mouse responds to the action of benzole much more quickly than a human being because its circulation is so much more rapid. So if the mouse topples over the man is not allowed to go in.

When I spoke on this subject two years ago before this section I urged the British method which is to leave the tank open for at least twenty-four hours after the usual cleaning out with water and steam. I was told that this was too slow for American industry, so if that can't be done, I should strongly advocate the use of the mouse test.

CHAIRMAN KERSHAW: There is another thing that might have a bearing on that. Mr. Burrell has just recently developed an instrument for determining the presence of explosive mixtures of gases. It is a very small instrument which draws in a sample of the air in the enclosure where the gases might be confined. This sample is ignited as a gauge to indicate the vacuum thus formed. Perhaps the explosibility of these vapors might have a direct relation to their toxic qualities.

The next question is: "How to prevent stoneware cock plugs from jumping out of place." Our company provides bridle plugs to hold them.

"Protection of repair men required to enter chemical tanks and apparatus against chemicals entering into them." Mr. De Blois of the du Pont Company several years ago said that the platform should be located so that the pipe would be within 18 inches of the floor of the scaffold, to prevent a repairman from being sprayed in the face.

"Respirators." Perhaps the most effective type of respirator for dust is made of several thicknesses of gauze made in the form of a pad and tied around the mouth and up under the nostrils. Some people place a little cotton between the layers of gauze. These respirators do not leak around the edges, and the men are usually willing to wear them. The snout respirators are very inefficient. The air is bound to leak around them, and the exhaled air often blows the dust right up into the corners of the eyes.

"Rubber, leather, and canvas gloves versus protective preparations, (paraffine, etc.) to put on the hands as protection against skin irritations or harmful burns."

DR. HAMILTON: We went into that subject very thoroughly during the war in connection with the handling of tetryl and T.N.T., especially by girls. We couldn't find any protective substance that worked. Most of them increased the solubility of these nitrates. Then we tried to make canvas gloves impermeable and all sorts of mixtures were tested

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out in Washington to keep the stuff from passing through. The canvas gloves were absolutely a failure. If any preparation did work, it made the gloves so stiff that the girls couldn't use them. We finally protected the face with a layer of zinc oxide ointment, dusted over thickly with talcum power, but we had to let the hands go.

There is a great objection to rubber gloves because if the glove has any imperfection and the powder works its way in, it meets a sweaty, macerated skin and acts much more powerfully than it would if there were no gloves at all. As you know, it is very hard to keep the rubber gloves perfectly whole. So it is probably much better to supply washing stations very liberally throughout the plant and encourage the men to wash their hands frequently and let the gloves go.

CHAIRMAN KERSHAW: Were you successful in having ordinary canvas gloves used but washed once or more each day?

DR. HAMILTON: I have seen that done and consider it quite satisfactory. The hands don't perspire as much in canvas gloves anyway.

MR. CRASS: We have discarded canvas gloves because they soil; then too, the powder does go through the glove and if a man has a break in the skin (and most of the men have hard callouses in their hands which are liable to crack) it is almost sure to cause trouble. We are using buckskin gloves. They cost about 75 cents a pair but they are impervious to dust and last longer than a dozen pair of canvas gloves; furthermore they do not get stiff when you wash them.

DR. HAMILTON: There is one objection to any glove; if a man has a fine job to do for a few minutes he takes off his glove and uses his naked hands; then with some of the material on his fingers he draws on his gloves again and is really poulticing his hands in the poisonous substance.

MR. CRASS: Yes, that is the objection to any glove. The rubber glove is all right where a man has to use acid temporarily, but where a man does work in it continuously and the hands perspire, I think it does away with them as a serviceable factor. We have tried rubber gloves and discarded them because they make the work more dangerous.

CHAIRMAN KERSHAW: In studying the toxic effect or poisoning effect of T.N.T., did you find that the most severe hazard was in the manufacturing or in the handling of T.N.T. after manufacture?

DR. HAMILTON: In the handling after manufacture.

CHAIRMAN KERSHAW: I think there must be something in the final purification of T.N.T. that has a lot to do with the poisoning effect thereafter. In our plants we made great quantities of T.N.T. during the war. Our records seem to indicate that the poisoning effect was only present where the oils were present—what we call the T.N.T. oils—but after the T.N.T. was purified and those oils were driven off, we had very few poisoning cases resulting thereafter.

DR. HAMILTON: That was the German experience. I always felt that pure T.N.T. was comparatively harmless.

ADJOURNMENT.

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Construction Section

September 27, 28, 1921

L. D. WOEDTKE, Chairman
Director of Safety, Fred T. Ley and Company, Inc., Springfield, Mass.

F. L. HURLBUTT, Vice-Chairman
Standard Safety Equipment Company, Chicago

A. P. GREENSFELDER, Vice-Chairman
Fruin-Colnon Contracting Company, St. Louis

F. A. DAVIDSON, Secretary
Safety Engineer, Dwight P. Robinson and Company, New York City

TUESDAY MORNING SESSION

AFTER appointing Messrs. Bush, Webb, and Walsh as a nominating committee, the chairman introduced Mr. L. L. Hall.

EXPERIENCE RATING OF CONTRACTORS' RISKS

L. L. HALL, SUPERINTENDENT, DEPARTMENT OF SCHEDULE RATING AND INSPECTION, NATIONAL WORKMEN'S COMPENSATION SERVICE BUREAU, NEW YORK CITY

In order to understand the effect of the accident record of an employer on his compensation insurance rate it is necessary to understand, in a general way, the making of the basic or manual rates for each of the various industries or trade. It is to be understood, of course, that when we speak of accidents in connection with the making of workmen's compensation insurance rates we are referring only to those accidents provided for by the compensation laws.

As our time is limited we shall have to think of the making of a manual rate for any classification or trade as being accomplished by adding together the losses paid by the insurers to workmen in that trade under policies written during a certain period of time, and dividing the total of these losses by the total payroll, in hundreds of dollars, of the same trades and for the period of time covered by the policies referred to. The resultant dividend is then, a pure loss cost for the particular trade and when properly loaded for the expense of doing business, or overhead, it constitutes a rate for insurance. This rate,

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though having been produced by adding together the losses for all risks in the trade, is an average and does not necessarily reflect the hazard of any individual risk in the classification.

There will be, as you know, all grades of risks in any classification or trade. There will be those where successful efforts have been made to prevent accidents with the result that the loss record or experience will be very good. There will be those where the record will be very bad and there will be all grades between. Obviously, it would be not only unwise, but also unfair, to charge all of these risks the same rate simply because of the fact that they happen to be in the same line of business. Some method of adjusting the manual rate to the individual risk must be used. In fitting the manual to manufacturing plants, the first step is made by the application of schedule rating, whereby fixed charges and credits are given for the presence or absence of accident producing conditions. This is not difficult to handle in a manufacturing plant where the working conditions are subject to but little, if any, change from day to day. Imagine though, the difficulty in rating construction work, with its constantly changing conditions, by means of a schedule. It is realized that in construction work there are physical characteristics which are indicative of hazard. In general, though, they vary so much from risk to risk that it would be impossible to evaluate them. For this reason experience rating, using the past record or experience of the risk, is the only method used to determine whether, and how much the manual rate for a construction risk should be increased or decreased.

Experience rating presents a problem involving contradictory evidence. Let us consider a contractor who does nothing but masonry work, and whose loss record has been excellent, that is much better than the average masonry contractor. There we would have the manual rate on the one hand, showing what was necessary for the average masonry contractor, and on the other hand, we would have the experience of the particular contractor indicating that his risk was not an average one and that his rate ought to be lower than the average.

This same sort of problem in contradictory evidence is found elsewhere. For instance, in courts of law the testimony of two witnesses will frequently conflict. In such a case the evidence that has the most weight in affecting the decision is the evidence that comes from the most reliable source, that is the evidence that appears most probable. In experience rating we wish to find out whether the manual representing the experience of the trade, or the experience of the individual risk itself is to be considered the more reliable guide to the future performance of the risk.

There are a number of elements that have a bearing on the solution of this problem. There is the matter of size of risk. Everything else being equal, the experience or past record of a large risk is a more reliable guide to its future performance than is the experience of a small risk. This may be seen very easily if we use an exaggerated illustration. Let us consider two employers in the same line of work, one with five employees, and the other with five thousand. Let us imagine that in the average risk of this class we expect each year to have one man in five

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injured. During a year's time then, we should expect one accident in the case of the small risk, while in the case of the large one, we should expect one thousand accidents. During the year 1920, neither of these risks had an accident. In other words, both were much better than the average of their trade. They were in fact, perfect. We now wish to try to predict the 1921 performance of these two risks. Which one of the two, in your opinion, would be the more likely to be better than the average during the year 1921? Perhaps you have never thought of this kind of a problem but at any rate a few moments consideration will convince you that the larger of the two is more likely to be better than the average during the next year. If the small risk experiences just one accident, it immediately becomes an average risk, while the large risk may experience anywhere from one to 999 accidents and still be better than the average. The fact that not one of the five thousand men working for the large concern was injured quite conclusively indicates that something is being done to prevent accidents, while the record of the small risk might have been due entirely to chance. If you will not accuse me of thinking lightly of accidents to men, I will illustrate this point a little more clearly: Suppose you tossed a coin five times, and each time it came up heads, you would be willing to believe that this was merely the working of the laws of chance. Suppose again, you tossed the coin five thousand times, and each time it came up heads. Would you be willing to believe that this was due to the workings of chance? Wouldn't you be more likely to think that something had been done to defeat the laws of chance? That perhaps both sides of the coin carried the impression of a head?

Another element is the degree of hazard. That is, everything else being considered equal, and with reasonable limitations, the experience of a hazardous trade is a more reliable guide to its future performance than is the experience of a non-hazardous trade. This is because the hazardous trade produces more accidents and gives a better chance of getting an average. For illustration, let us imagine one hundred men in each of two trades. In one trade, we expect one out of each five men to be hurt each year,—in the other we expect one out of each one hundred men to be hurt, each year. During the past year, there have been no accidents in either risk. Which of the two risks appears more likely to be better than the average during the coming year? In the case of the first employer where we expected one man in five to be hurt, we would expect twenty accidents with the one hundred men, so this risk can have anywhere from one to nineteen accidents, and still be better than the average. In the case of the other employer where we expected only one accident per one hundred employees, it will become an average risk if it experiences only one accident. Here we can go back to our coin illustration. The fact that we had no accidents where we expected twenty, indicates that the risk is doing something to prevent accidents, and that its record is not merely the result of chance; while in the other case the record does not so conclusively indicate that the results are anything more than the operation of the laws of chance.

So far we have spoken of accidents in a numerical way, and as though

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they were all alike. There are, however, all kinds of accidents from those requiring but a few moments of medical attention, to the fatalities and permanent total disabilities. In experience rating it is the cost, rather than the character of the accident, that is shown. Here, then, we have another element that affects the credibility of the experience. It becomes necessary to distinguish between certain types of accidents. We may have two employers in the same trade, each with the same number of employees and each having an accident cost record of the same amount, say five thousand dollars, for a certain period of time, and yet, one risk may be much worse than the other. In one case, the five thousand dollars in cost may be entirely due to one fatal accident. In the other case, the cost may be due to fifty accidents, occurring at different times, and averaging one hundred dollars each, in cost. You certainly could not think of the first case as being as bad as the other one. In the first case, they had only one accident, which happened to result fatally, but that does not necessarily indicate that there was any undue lack of attention to accident prevention. In the other case by comparison with the first, we are likely to think there is something wrong. The twenty accidents certainly could not be entirely the result of chance. For this reason, in experience rating accidents are reported in two groups. One group comprises the accidents of low frequency and high individual cost, that is, the deaths and permanent total disabilities; the other group comprises the accidents of high frequency and low individual cost, that is, the other compensation costs, and also the medical.

By having the risk losses in these two groups, we are enabled to separate the comparison of the experience of the risk with the experience of the class, into two parts—one part, where comparison is made between the death and permanent total disability record of the risk, with the corresponding record of the class; and the other, where the other compensation and the medical losses are compared with the class record for those losses. In the comparison of death and permanent total disability records a material divergence between the risk and class records will have but little effect on the final rate, for the reason that as before indicated, these losses, dollar for dollar, are more the result of chance, and less indicative of risk quality, than are the losses in connection with the less serious accidents.

On the other hand, the risk record as respects the less serious accidents, is a quite significant index to the degree of care exercised, and accordingly a divergence from the class record is allowed to have a much greater effect on the final rate.

(Here Mr. Hall turned from theory to practice and with the aid of blackboard illustrations discussed the practical application of the points which he had presented.) In answer to questions, Mr. Hall stated that the loading for overhead is generally 38 per cent; and emphasized that it is unnecessary to allow credit to contractors for establishing safety organizations, and for the use of standard safety equipment, because through the experience rating plant the contractor obtains all the advantages that he would acquire through the adoption of schedule rating. The chairman then introduced the next speaker.

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BOOSTING SAFETY THROUGH CONTRACTORS' ORGANIZATIONS

FRANK S. ROBINSON, SECRETARY, GENERAL BUILDERS' ASSOCIATION, DETROIT

The members of the General Builders' Association of Detroit have, to use a well-worn expression, "been sold" on the safety idea in construction work ever since its organization. We have, however, gone a step further in this direction in that the individuals of the firms comprising our membership take a real and continuing interest in the movement, and this means the "higher ups" as well as the "lower-downs". It is only through this whole hearted sympathetic assistance that we have been able to accomplish what we have accomplished in the reduction of accidents both as to frequency and severity. It has taken some time and thought to arrive at the point where we are now. Our methods have changed many times and old work has been scrapped but we feel that we now are on the right road.

You all have heard time and again some one say that "Safety work is all right in the shop but it can't be done on construction work." Well, it is being done—but the matter is one too serious for careless or apathetic treatment. Hindrance is quite apt to come from within as well as from without. Heads of firms are very apt to blame some one or two in their organization for the showing made in their accident record, or blame their safety department if they have one. If they have no safety department they are quite apt to let the accident pass by, saying to themselves "What difference does it make? The insurance company will take care of it." They are like the person cheating at solitaire—only fooling themselves, as they will realize if they only take the trouble to look into the rates they are paying.

Many individual contracting firms have their own safety department, some of which you are familiar with and know of the good work they are doing, but I do not know of another instance where a contracting or building association has undertaken this work as a unit for the benefit of its members.

In the first place the compensation insurance and the public liability insurance of all of our members is taken out in one insurance company through a local agency. This is one of the requirements of our association for were it otherwise there could be no control of service, inspection, or rates. So in this respect we are on the same plane as an individual firm although each member of course takes out his individual policies. The insurance company with which we do business assists us in every way to make our safety work a success. The service it and its local agent renders is of the highest order and there never has been an instance of any quibbling over the settlement of a claim. In fact the company leans backwards in this matter.

SAFETY COMMITTEE

Our safety work is carried on through a safety committee which is composed of one representative from each of our members, one from the insurance agency, and the safety engineer of the insurance company.

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The committee holds monthly meetings where various safety and insurance matters are discussed, and accident reports and records are gone over. Another duty of each committeeman is to see that notice of each new job started by his firm is sent to the insurance company. This is so investigation can be made at the start of operations as to hazards on the job and of any possible excess limits required, and also to notify the safety engineer. He also sees to it that accident reports are promptly and properly made out and sent to the proper parties; that data for our monthly accident record is prepared; and that appropriate sections of the safety code are sent to each job as the work progresses.

MONTHLY ACCIDENT RECORDS

These records are compiled by the association every month for each member. They show the cause and nature of injury, date of accident and date of return to work, etc., in fact they are prepared according to the recommendation of the Statistical Committee as adopted at the last Congress. Reports showing the percentages of all members are then sent to them. In this way the member can compare his record with the record of others, thereby creating a friendly rivalry in the effort to have the best score.

SAFETY ENGINEER

A safety engineer from the insurance company devotes practically his whole time to the work of our various members. This position requires a man of tact and we are fortunate in having one with this qualificaiton; one who gets along well with the men and whose suggestions for betterments are taken in the spirit of a willingness to co-operate for the general cause.

BOARD OF INQUIRY

This board, a branch of the safety committee, investigates serious and fatal accidents and reports its findings to members through their committeeman. It is not the purpose of the board to recommend any punishment in connection with its findings. But it is intended that the superintendent or foreman in direct charge of the operation on which the accident occurred should be made to feel his responsibility in the matter. Other members are notified of the cause of the particular accident with the object in mind of avoiding repetition. The board is composed of the secretary of the association, a representative of the insurance company, a representative of the insurance agency, and a representative of the member whose accident is being investigated.

FIRST-AID CLASSES

First-aid classes are held weekly except during the summer months. They are in charge of the chief surgeon of the insurance company and are held at the private hospital of the company. The classes are attended by superintendents, foremen, first-aid men, and the workmen who are sufficiently interested. About twenty men attend each week and the classes are given in series. The first series consists of instruction in stopping flow of blood, fainting, and fractures; the second series, of

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instruction in hemorrhages, wounds, and bandaging; and so on. Great interest is taken in these classes by the men and they have proved to be very beneficial.

WELFARE DEPARTMENT

This department, maintained by the insurance company, provides injured workmen and their families with a personal kind of service that goes a long way to remove any harshness in the relations between disabled employees on the one hand, and employers and insurance carriers on the other. The welfare worker goes to the hospital and to the home of the injured as a representative of the firm for which the injured worked and not as a representative of the insurance company. This at once creates a feeling of personal relationship as between master and servant and tends to show that the human side of industrial relations is not overlooked. The welfare worker who looks after our work is a graduate nurse and an experienced social worker. Her work includes the visiting of seriously injured in hospitals or homes, furnishing them with reading matter, tobacco, etc., during convalescence and otherwise keeping them contented. A more important feature of her work is that done among families of the men injured. On receiving notice of a serious accident, she proceeds to the home of the injured man and breaks the news to his family if this has not already been done. She investigates their condition and learns whether they are in a position to live with reasonable comfort during the disability of the injured, since it often occurs that the family is thrown into destitute circumstances by reason of loss of wages. She immediately takes steps to remedy the conditions as far as possible. A report is made to the claims department and to the employer, also if necessary to charitable institutions, the man's church, and his fraternal organizations. Necessities of life are provided and compenastion is advanced if necessary. This kind of service relieves the injured from mental worry as to the care of his family, helps him to get well sooner, and creates a fair and friendly feeling on his part toward his employer.

SAFETY CODE

The safety code is just another one of our efforts to reduce accidents. The code is not intended to be a technical treatise on strains and stresses or anything of that sort, but it is intended to be a reminder to those in charge of the work of the various hazards they must watch for in order that the men under them may be further protected. Men in the daily routine of their work become careless, and carelessness is the greatest cause of accidents. The code reminds them to "be careful".

The code is got up in loose leaf form and a section relating to each particular branch of the work is sent out as the job progresses. The foreman may have forgotten some little thing to which the code calls his attention and by being reminded of it he will cause the thing to be done and thus probably prevent an accident.

The code was compiled from actual practical experiences of our members and from some publications which contained information which was felt to be of value. To these publications we are duly indebted. While

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there are several items in the code that are entirely local in character, the Construction Section is welcome to use the idea if it feels it will be of any benefit. Changes in it will of course be necessary to suit local conditions and we expect to add to it from time to time as our experience justifies. The code has been copyrighted as a protection against the possibility of some unscrupulous publisher taking it in whole and using it for profit.

The General Builders' Association of Detroit not only believes in but has pioneered and followed up the business of controlling accidents to employees long enough to know positively that safety pays most handsome dividends. We have proven the fact, beyond any question, that carelessness and accidents do not produce efficiency; but that safety does that very thing.

Try to get this picture in your mind—as we reduce our accidents, so do we reduce our insurance rates. Similarly we increase the efficiency of our workmen and attract a better class. We believe it is not impossible to bring low insurance costs and high efficiency so closely together that while we always shall pay premium we shall be repaid totally in the form of added production, besides having the consciousness of rendering a magnificent service to humanity through elimination of human suffering and saving human life.

DISCUSSION

Mr. A. E. Davidson (Chesebro Whitman Company, New York City): How long has your organization been using this plan?

Mr. Robinson: About five years.

Mr. Davidson: It is good to hear a paper like that because we all think the whole world is going to smash, and it was only about five years ago that we said this couldn't be done in construction work. It can be done!

Chairman Woedtke: There has been a demand on the part of some of our members to learn something more about the mechanical safeguarding end of the construction game. We think, eat, and sleep the educational factor all the time—getting a man to think straight and showing him what to do and what not to do—but we pay very little attention to the mechanical end.

While Mr. Talbot, our next speaker, is a hundred per cent safety man at heart, it is not a matter of bread and butter with him as it is with most of you; his business has to do with equipment and machinery from the largest to the smallest piece. He has done such remarkable work in mechanical safeguarding with his firm that he is very well qualified to give you some idea of what can be done and how. Mr. Raymond A. Talbot.

THE MECHANICAL SAFEGUARDING OF EQUIPMENT

Raymond R. Talbot, Manager, Equipment Department, Fred T. Ley and Company, Inc., Springfield, Mass.

We are told by statisticians that only a minor percentage of accidents can be prevented by mechanical means, the percentage ranging from 20 per cent to 40 per cent, according to the industry or authority in question.

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However true this may be, the fact remains that there is always a certain amount of mechanical safeguarding which any industry or firm must do if it attempts seriously to reduce preventable accidents to a minimum, as surely an employer cannot begin to talk safety education or expect co-operation from his employees unless he goes through on his part and provides all reasonable mechanical safeguards.

With this done the employer can look his men square in the eye and not only ask but morally demand equally reasonable and intelligent support and co-operation from his empoyees in this all-important matter of accident reduction.

The purpose of my paper is to analyze and show how this can be done in the construction industry, and you may be sure that I am mindful of the fluctuating conditions and constantly shifting locations involved in the contractor's business, which makes this problem so much more difficult for him than the industrial executive, whose plant stays "put" in one place year in and year out.

Let us split the subject into three parts. First, what mechanical safeguards can be secured at the time of purchasing machinery, tools, and equipment. Second, what reasonable mechanical safeguarding can be done by the contractor before the "plant", tools, and equipment leave the contractor's yards, assuming that the safeguards were not provided at the time of purchase. Third, what is reasonable and just to expect of the job in providing and maintaining mechanical safeguards.

1. WHAT MECHANICAL SAFEGUARDS CAN BE SECURED AT THE TIME OF PURCHASING MACHINERY, TOOLS AND EQUIPMENT?

A simple set of suggestions is presented herewith which may be helpful in ordering new equipment, such as steam shovels, boilers, hoisting engines, power saws, woodworking machinery, concrete mixers, etc.

All boilers to be equipped with approved gauge glass guards.

All gears, keys, protruding or revolving parts to be guarded on all mechanically driven equipment.

All saws and other woodworking machinery to be fitted with approved guards.

All platform elevators to be equipped with safety devices for protection against the elevators dropping from cable breaking.

Adequate and safe grab handles, steps, etc., to be provided on locomotives, cars, cranes, steam shovels, and transporting equipment.

All electrical control switches to be of approved safety type, properly enclosed.

Cans for gasoline and flammable oils to be of approved safety type.

Safety type of racks or holders should be provided for acid containers.

Price of striking hammers, hand and stone hammer, or any hand striking tools should be secondary, as the first consideration should be quality and safety features which might very well be standardized by the code committee which I shall refer to later.

Ladder specifications have already been drawn up by industries other than construction. Codes have also been established in several states under supervision of labor boards. While this ground has been covered

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somewhat by different groups of men and industries, there is much need of standardizing ladder specifications for contractors. However, one recommendation can be made here, namely that ladders should never be covered with pigment paint as the use of linseed oil and shellac is to be preferred.

I understand that there are committees of the National Safety Council and engineering societies which are formulating codes and standards for the construction industry, and I would heartily recommend that they take up these subjects at the earliest possible date to the end that purchasing agents of contracting equipment may have the use of a uniform set of specifications.

2. WHAT REASONABLE MECHANICAL SAFEGUARDING CAN BE DONE BY THE CONTRACTOR BEFORE THE PLANT, TOOLS, AND EQUIPMENT LEAVE THE CONTRACTOR'S YARDS?

Hoisting Equipment. All gears, revolving projections, and clutches should be thoroughly enclosed or otherwise protected by the equipment department in accordance with approved recommendations and practice.

Steam Boilers. All boilers should be furnished with removable gauge glass guards when shipped from the equipment plant as well as all regular fittings.

Circular Saws. All table saws should be equipped with approved types of spreaders and saw guards when shipped from the equipment plant. All swing saws should have the top half of the saw blade completely enclosed by the equipment department.

Jointers or Buzz Planers. The equipment department should furnish all jointers or buzz planers with cylindrical or safety heads and if replacement of same becomes necessary at any time these types only are to be used. The equipment department should also furnish an approved type of guard for jointer heads.

Pulley Blocks. The equipment department should see to it that all pulley blocks have the proper thickness of sheaves so that there will not be any unnecessary space between the sheave and the shell, such as would cause jamming or slipping of cables or ropes.

Builder's Elevators. The equipment department should see to it that all the unused sides of builder's elevators are boarded up and that the platform elevators furnished by them are equipped with a safety device to hold the elevator in case the cable breaks.

Electrical Equipment. The equipment department should furnish the enclosed or "dead front" type of switch whenever they can be used by the jobs.

Gasoline and Kerosene Cans. The equipment department should furnish an approved safety type of can for containing gasoline only. I recommend a different type of can for kerosene for fear that kerosene and gasoline may be mixed. All cans should be stenciled in red or white letters either "gasoline" or "kerosene".

Engine Driven Cement Mixers. The equipment department should provide an approved housing about all cement mixer engines to enclose all moving parts, including shaft ends.

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Automobile Trucks. The equipment department should furnish signs reading "Danger—keep off".

Locomotives. The equipment department should install grab handles and steps on all locomotives they furnish, and should also furnish gauge glass guards for all locomotives.

Chisels and Hammers, Drills and Bull Points. All chisels, hammers, drills and bull points sent out from the equipment department should be properly dressed on hammer faces or head and all handles should be properly wedged and tightened.

Car Dumping Wrenches. The equipment department should furnish car dumping wrenches when specified or requested by the job.

Portable Ladders. All ladders sent out by the equipment department should be tested as well as having same treated with linseed oil and shellac instead of paint.

The equipment department should paint all parts of equipment in red where any such part is covered or protected by mechanical guard, so that when any such guard is removed the bright red underneath will immediately become apparent, and call attention to the missing guard.

The equipment department should furnish and attach to each piece of equipment or machinery on which there are or should be mechanical safeguards, a tag listing the safeguards and naming them.

3. WHAT IS REASONABLE TO EXPECT OF THE JOB IN PROVIDING AND MAINTAINING MECHANICAL SAFEGUARDS?

Hoisting Equipment. The job should see to it, if it becomes necessary to temporarily remove any guards, that they are put back into place without fail before the equipment is put in use again.

Steam Boilers. The job should be responsible for installing the detachable gauge glass guards as well as all fittings, and the job superintendent or master mechanic should see to it that all attachments are in working order and are tested at least once per week, as well as complying with all state requirements wherever the job is located. I recommend that the blow-off cock be opened at least once per day, preferably at the time of steaming up in the morning, as any scale or sediment which would have accumulated during the previous day and night can then be blown off. This will insure better steaming and preservation of the boiler as well as preventing accidents.

Circular Saws. The job should provide a definite stop on swing saws to prevent the top of saw from travelling beyond the front edge of the working table. It will also be necessary to chain the counterweight to the frame of the machine or other convenient fixed object to eliminate the possibility of its falling on the operator.

On treadle operated swing saws, the job should install a strap over the treadle so arranged as to prevent accidental operation of the treadle.

The job must also provide adequate guards for belts, pulleys, and revolving projections in connection with the driving of the different types of saws.

Complaints are often made regarding saw guards removed and not put

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back in place, as well as equipment returned with guards missing. The job superintendent should be held responsible in such cases.

Jointers or Buzz Planers. The equipment department should do whatever guarding of belts, pulleys, and revolving projections is possible on the jointers and planers, but the job should provide the guarding of belting and shafting when planers are driven from countershaft.

Builder's Elevators. The job should see to it that the unused sides of the elevator are properly boarded up and that the openings to elevator wells are properly guarded, as conditions on the job require.

Electrical Equipment. The proper safeguarding of electrical equipment, wiring, switch and fuse cut outs, must be taken care of by the job and this is controlled more or less by local building codes with which the job must become familiar.

Gasoline and Kerosene Cans. The job superintendent should see to it that a responsible person is in charge of handling gasoline and kerosene, as serious accidents will certainly result if lanterns are filled with gasoline by mistake.

The job should be expected to stencil or letter "Gasoline" or "Kerosene" in fairly large type on any cans they purchase or provide themselves.

Engine Driven Cement Mixers. The job should be responsible for keeping the doors of such housings closed when the operator is not working on the engine with the exception of such doors as must be left open for air.

Automobile Truck Signs. These signs caution persons from riding on the trucks and the job superintendent should be responsible for their being in place.

Chisels and Hammers, Drills and Bull Points. The job must keep all such tools properly dressed as well as all handles wedged or tightened, and the job blacksmith or whoever dresses such tools should be instructed and followed up in this regard.

Portable Ladders. The job should be required to test all ladders periodically and discard or destroy (as advisable) any unsafe or unsound ladders. Under no circumstances are ladders to be painted with lead and oil which treatment covers up defects or weak spots that would otherwise be noticed.

On receipt of machinery or equipment by the job, the list on the tag referred to under section 2 should be checked and if parts are missing, the same should be reported immediately to the equipment department and the job should be charged with any such parts which are missing when the machinery or equipment is returned to the equipment department.

It is also of great importance that the job when returning equipment, sees to it that all detachable safeguards are properly boxed and shipped with the equipment, whether the equipment is being returned to the contractors' general storeyard or being shipped to another job.

DISCUSSION

Miss Mary A. Townsend (Irwin and Leighton Company, Philadelphia): Our purchasing agent looks after the purchasing of equipment and sees

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that the equipment goes to the job properly guarded, and we hold the job superintendents responsible for any accidents.

What do you use to protect a man's hand when holding a chisel with another man striking? We have been using heavy wire.

MR. TALBOT: Wire would be better than iron.

MR. M. C. GOODSPEED (General Electric Company, Erie, Pa.): One of our men made himself a clamp, of two pieces of wood connected by a piece of strap belting. He can turn his hand enough to turn the drill.

(Secretary Davidson urged that all purchasing agents should impress on all equipment salesmen the need of proper mechanical safeguards, and should specify the types of such safeguards.)

MR. WEBB: I bumped into a new kink on a certain construction job. It has to do with the nail hazard. The superintendent offered the water boy five cents an hour more and appointed him official "nail hound". He is the man who gets into every corner of the job, and this increase in pay is given to him with the instructions that he is to knock down every nail that he sees. You always have the club over the water boy's head, because if you see a couple of nails you can say, "Look here, Jacky, I saw a few nails that you didn't get, and if you don't do a better job I'll take this five cents increase away from you."

This superintendent says that he has had better success with the nail hazard by that means than any other thing he has tried.

CHAIRMAN WOEDTKE: That is a mighty good suggestion. That official name "nail hound" is good.

MR. H. M. BURKE (Mount Hope Finishing Company, North Dighton, Mass.): We use tons of dynamite every year, and I should like to know how to reduce this hazard.

MR. WEBB: One man should be made responsible for the magazine and the handling of the dynamite. In no case should caps be transported with dynamite or kept in the same magazine with them. In taking the powder out of the magazine, it is a very good plan not to remove the sticks from the box in the house—carry the case outside and take what you need out of it, and then replace the box. Use a copper or wooden mallet in opening the boxes.

Frozen dynamite is a real hazard. I have seen it put in ovens. That is a bad practice! It usually winds up with somebody getting ruined for life.

There is one very simple method of thawing dynamite. Get a milk can, put some straw in it, lay in your sticks of dynamite; then get a keg that is water-tight, fill it full of warm water, insert the milk can, and your frozen dynamite will melt very quickly.

CHAIRMAN WOEDTKE: That is the same way that your wife cooks with a double boiler.

MR. WEBB: The same way.

When your powder is out of the magazine, don't put it close enough to the operation so that it will get the shock from the explosion. The concussion is liable to explode the remainder of the powder in the box.

As a matter of fact we should never take any more powder or dynamite from the storehouse than there is need for. One man should be respon-

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sible for that and know exactly where it is. In no case should the caps be kept near the location of the quantity of dynamite you are using. I have seen this done time and time again: Taking a piece of metal—a spike, for example—and inserting it in the cartridge to make way for the cap. A stick or a lead pencil is much safer.

Don't use a piece of pipe to tamp down the sticks. Have an experienced blaster who knows the quantity of explosives to put into the hole to get the best results and not to shatter the window panes and wreck houses round about.

If you will direct any further inquiries to the Service Department of E. I. du Pont de Nemours and Company, Wilmington, Del., I feel pretty sure they can give you any information that you want.

ADJOURNMENT.

WEDNESDAY MORNING SESSION

THE second session of the Construction Section of the National Safety Council was called to order by Chairman L. D. Woedtke.

On report of the nominating committee, the following were unanimously elected officers of the section for the coming year: Chairman, F. A. Davidson, Safety Engineer, Dwight P. Robinson Company, New York; First Vice-Chairman, F. S. Robinson, Secretary, General Builders' Association of Detroit; Second Vice-Chairman, W. F. Ames, Safety Engineer, McClintic-Marshal Construction Company, Pittsburgh; Secretary, J. H. Schults, Safety Engineer, James Stewart Company, New York. The chairman then introduced Dr. Risteen.

PROTECTING THE PUBLIC

A. D. RISTEEN, DIRECTOR OF TECHNICAL RESEARCH, THE TRAVELERS INSURANCE COMPANY, HARTFORD, CONN.

The protection of the public in connection with the construction of buildings is often closely related to the problem of protecting the employees, and it is not always easy to separate the two by a definite line of demarcation. I will ask you, therefore, to bear this fact in mind, when it might otherwise appear that I am straying from my subject.

DEMOLITION

Let us consider first the demolition of such structures as may already exist upon the site where the building is to be erected. In this part of the work many accidents occur, and the reason is fairly plain. Everybody understands pretty well that the workmen must be protected while engaged in the actual construction, even though differences of opinion exist as to the extent to which protection should be provided; but in the preliminary work of demolition we often find that the contractor feels that no special precautions are necessary—apparently because the operations that are involved are of an inferior grade, when judged from an engineering standpoint. Any such view as that is highly illogical however, because a brick, for example, can kill a man just as quickly if it

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falls on his head while tearing the building down, as it can if it strikes him from the same height while putting the building up. I beg your pardon for obtruding such a simple and obvious fact upon your attention, but it is a matter of common observation that contractors do not always accept it as a fact. At all events, they do not adopt it as a basic principle in the conduct of their work.

In tearing down a building, the demolition work should be conducted systematically, proceeding floor by floor, and beginning at the top. An adequate space for the protection of the public should be fenced off along the sides of the building that abut upon streets or come near them, or else substantial sidewalk sheds should be constructed. The demolition work is usually conducted by a separate contractor who is experienced in this particular kind of work, and the shed that he is likely to build over the sidewalk will probably be inadequate for the protection of the public in the subsequent work of construction. Hence we are faced by a troublesome situation, inasmuch as it becomes necessary either to build two sidewalk sheds (one to serve during demolition, and the other to serve during construction); or else the sidewalk shed built by the demolition constructor must be continued in use throughout the construction period; or else the shed that is to be used during the work of construction must be erected at the outset and before the demolition begins. According to my own ideas, this last solution is the best one. The demolition contractor and the construction contractor ought to be able to get together and settle this matter to their mutual satisfaction.

If the location of the building is such that a shed is necessary, the construction contractor will have to have one in any event, and so also will the demolition contractor; and if the demolition contractor is willing to pay a fair proportion of the cost, I see no good reason why the construction contractor should not be willing to put up his final shed at the very outset.

It is highly important to avoid overloading sidewalk sheds. Accidents result from such overloading, every little while. I recall one, for example, which occurred in New York, killing one man and injuring five others, and further examples could be given without any great trouble.

Don't throw down material from elevated places. Lower it by means of suitable tackle.

Keep persons away from the discharge ends of material chutes, and place danger signs at the ends of such chutes. Every chute should have at its lower end, a gate of some kind, which should be kept closed except when the chute is in use under proper supervision.

Do not allow broken glass, or jagged fragments of sheet-metal, to lie about in the streets. Don't allow children to play on piles of salvaged material, and if you permit them to carry away firewood, see that they cannot be exposed to danger in removing it.

EXCAVATIONS

It is highly important, in connection with excavation work, to effectively and safely shore up adjoining building foundations, and the walls of the buildings themselves, when there is the slightest doubt about the

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security of the foundations or walls in case such shoring should be omitted. The sides of excavations adjoining streets or passageways should also be substantially shored up, in order to prevent caving. Of course the excavation should be shored elsewhere for the protection of the employees, but I emphasize the importance of shoring in the vicinity of the streets, because my subject is the protection of the public. The sidewalks should be properly shored up unless they are actually removed, and the shoring should be specially strong and safe when the excavation operation extends out under them.

The walls of excavations should be carefully watched to detect any signs of danger, and after heavy rains the inspection should be specially frequent and thorough.

Planks that are laid down on sidewalks for carts and trucks to pass over should be laid so as to minimize the tripping hazard to which the public is subjected. Such planks should be fastened in place, if necessary, and it is advisable to bevel them at the ends. They often become warped so that the ends stick up, and constitute serious hazards to foot-passengers who are using the sidewalk. Any tendency in this direction should be promptly remedied.

Where wagons or motor trucks enter or leave areas that are undergoing excavation, men should be stationed to regulate the sidewalk traffic so that foot-passengers will not be exposed to danger from such trucks and wagons.

When fences are used around areas undergoing excavation, build them of clear lumber, lay the boards tightly together, and see that they are free from knot-holes and cracks. Every opening or peep-hole is sure to attract idle or curious members of the general public, and you can usually tell from a considerable distance where every knot-hole or crack is, because somebody will be standing close to the fence, looking through it.

Under some circumstances it may not be necessary to use a solid fence to protect an excavation, but in a case of this kind stout railings and toe-boards should be provided along the edges, and lights should be employed at night whenever they would tend to lessen the danger to which the public would otherwise be exposed.

When it is necessary to do blasting, use suitable blasting mats and logs, and do the work with charges as small as practicable. Whenever a charge is to be exploded, see that everybody is kept at a safe distance when the shot is fired. Do not store any considerable quantity of explosive on the job, but bring what is needed to the work place, in lots as small as possible. When any explosive is stored in or near the excavation, or when there is danger that somebody might prowl around the premises and be hurt in any other way, provide a watchman and put him in charge of the premises at all times when the work is not actively going forward.

CONSTRUCTION WORK

Most cities have ordinances calling for the erection of sheds over the sidewalks where foot passengers might be exposed to danger from falling materials, and even when there is no such requirement, sheds of this

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kind should be constructed if there is the least chance of injury to the public, and they should invariably be strong and be erected on secure foundations. Sheds of this kind are often overloaded with building material until they are in danger of collapsing. Such a condition can easily arise in consequence of material being delivered faster than it is used. A careful watch should be kept on the bridges at all times, to see that this error is not committed.

The contractor's office is frequently placed on the sidewalk shed, where it would be likely to be struck by falling materials. In fact, the location of the office often causes the thoughtful passer-by to ask himself what the construction company has against its contractor, that it should consent to his exposing himself to so serious a hazard. The contractor is an employee in a certain sense and therefore he might not come within the province of this paper; but his office is frequently visited by persons from outside, and this makes it appropriate that I should refer to the matter.

When the building has reached such a height that there is danger that things falling off might not be caught by the sidewalk shed or that they might strike it with such force that they would perhaps go through it, or rebound and jump over into the street, it is important to provide elevated platforms or "catch scaffolds" around the building at such heights as may be necessary, to supplement the sidewalk shed and retain such things as might fall from the upper levels of the building.

In many cases it is advisable to roof over an entire street, when a simple sidewalk shed would not demonstrably provide complete protection.

Keep materials as far away as practicable from the outside edges of the building. This applies to all floors above the ground level, but it is specially important on the higher floors.

Don't leave light material lying about where it may be blown off from the building by a high wind. This applies specially to boards and other objects that have a large area in comparison with their weight.

Don't allow your riveters to throw rivets toward the outside of the building. A red-hot rivet landing on a pedestrian's head is anything but pleasant.

When the construction reaches such a point that men are working about the windows, provide window guards or screens to prevent the fall of tools and other things that might be dropped from the windows. It might be preferable to be struck by a red-hot rivet, rather than by a monkey wrench falling from the same height. Material that must be stored in the streets should be piled carefully, so that it cannot fall over, and so that it will not occupy a needless amount of space; and it should also be prominently and conspicuously marked by red lights at night.

Don't locate mortar beds where persons may step or fall into them. This applies specially to children, who do not know what a mortar bed is.

If chipping operations are going on, provide screens to protect the public from the chips, whenever the operation is being conducted so that the chips could do harm.

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Where a building or the fence inclosing a building is located on a corner, around which trucks or other vehicles are likely to come, post the danger point with conspicuous signs. We often see building jobs inclosed by fences at street corners, under such conditions that nothing short of a special dispensation of Providence can prevent an accident, unless the danger is appreciated and suitable protection is provided against it.

Do not allow unauthorized persons to enter upon the job, and station guards at the entrances for the purpose of enforcing this regulation, as well as to see that pedestrians are not injured by trucks entering or leaving the premises.

Concrete forms that have served their purpose should be piled in an orderly fashion, so that they cannot fall over and cause injuries. In general, everything that has served its purpose should be removed from the premises as soon as practicable, and this of course applies to concrete forms as well as to other things.

I suppose we shall always have the nail hazard with us. I do not need to enlarge upon it, but I must at least mention it. There is not a man here who does not appreciate the danger associated with nails projecting from boards and planks that have been used on the job, and that have subsequently been allowed to lie about. I have often said that never in the history of man did an employee lay down a board without having the points of the nails sticking up, but I want to take that statement back. It is not true, because a little while ago I saw a board lying with the points of the nails downward. But although I desire to retract my statement about the absolute universality of the thing, I still insist that a discarded board with the nail-points turned downward is rare enough to be a candidate for a museum. I once made a bet—a small one—to the effect that in a certain pile of flotsam and jetsam of this kind that I had not been near, not one single board would be found to have the nail-points turned downward. There were nearly a hundred of them in the pile, but I won the bet.

HOISTING

In many cities there are ordinances forbidding any person to hoist material of any kind over sidewalks, highways, passageways, or other places where the public is allowed to pass or to congregate; and even where there is so such ordinance, the principle that is involved should be recognized and applied, so far as practicable. In case it becomes really necessary (that is, if the necessity is real and not imaginary), to hoist materials over sidewalks or other thoroughfares, the protection that is afforded to the public must be unusually stout and strong, so breakage of tackle, or other unforeseen accidents cannot possibly do any harm.

When hoisting engines are located in the street, guard the boilers, engines, and all hoisting cables, so that passers-by cannot be injured. Material hoists, when located in the streets, should be tightly inclosed.

All hoisting towers must be substantially constructed, and securely

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guyed or otherwise made absolutely secure against the possibility of tipping over.

When stopping work for the night or at any other time, lay the derrick booms down or top them up, to prevent them from swinging about in case of high winds and fouling the guys.

Whenever derrick guys pass over streets or sidewalks, they should, if possible, be placed at such a height that the traffic, whether in the street or on the sidewalk, can pass under them safely. If this is not possible, attach prominent danger signals to the guys so that all chance of accidental contact with them will be eliminated. Guys of this kind should be well lighted at night so that the danger will be equally obvious; and if satisfactory protection cannot be had in these ways, then the area within which the danger exists should be fenced off so that nobody can enter it.

Wiring for electric motors should be properly installed, firmly secured in place, and well insulated; and all switchboards and other similar apparatus should be effectively railed off, so that nobody can come in contact with them.

I have outlined the main features that should receive attention in protecting the public where building operations are going on. Much more might be said on the subject, but if these precautions are faithfully observed, there will be comparatively little trouble from the exposure of the public to the hazards that remain.

(Dr. Risteen then showed lantern slides illustrating some of the points mentioned.)

CHAIRMAN WOEDTKE: Doctor, we are very grateful to you for the splendid presentation of this problem that you have made for us this morning.

Mr. A. H. Lewis has sent us a telegram saying that he is unable to be present. He has sent his paper along, however, and I will ask the secretary to read it to you.

CO-OPERATION OF THE SUB-CONTRACTOR IN ACCIDENT PREVENTION

A. H. LEWIS, MANAGER SAFETY DEPARTMENT, THOMPSON-STARRETT COMPANY, NEW YORK CITY

Speaking from several years' experience with sub-contractors, and also from an experience in which accidents were caused to our employees due to safeguards being removed by the employees of sub-contractors, who almost invariably fail to replace the safeguards provided, I wish to call to your attention our problem with such sub-contractors.

Trades doing work different from our own, who, in the natural course of events, follow in our wake, find safeguards for the prevention of accidents. The safeguards, it is claimed by them, are in the way of their completing their particular work. The safeguards are removed temporarily, the sub-contractors' workmen hoping to remember to put them

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back in their proper places, but failing to do so, with the result that a very serious accident occurs. Many such accidents have resulted from this negligence on the part of workmen of sub-contractors, both to our workmen and to theirs, and we have made repeated efforts to find a correction. Our efforts in this direction have borne fruit in some cases, and in others failed. This failure has been due more to the "human element" entering in than to any other cause.

The remedy we would advocate is to keep everlastingly at it by talking to the foremen of sub-contractors, and pointing out to them the reasons safeguards are used by us; also by bringing to the foremen's attention the suffering caused by accidents.

The scheme of charging to sub-contractors the cost of replacing safeguards removed by them has been tried out, and while it has been beneficial in some instances, in my opinion it has failed. The remedy, as I see it, and it must come, is for the owner to pay for such safety protection as is necessary. This will allow sub-contractors to put in their estimates an allowance for protection and safeguards. With this scheme in vogue it will be possible for the general contractor to appoint a person whose sole duty will be safety work, to watch all sub-contractors and, where faults are seen, to correct them at once and draw the attention of those responsible, with a view to avoiding a recurrence; as rail-guards, ladders and other safeguards are removed, to see that they are immediately put back in their proper places, the expense for such to be charged to the sub-contractor.

The writer, while in the course of preparing a paper on this particular subject, made a trip over the various jobs in the course of construction by this company located in various cities, and talked with the superintendents on the jobs with a view toward getting an impression from them as to the best method to be prescribed for the handling of the sub-contractor. Strange as it may seem, not one of them could offer a suitable remedy.

This fact, I believe, brings out emphatically the point I have already mentioned regarding the extra allowance the owner should provide for safety protection. This would bring the results that are hoped for with a minimum of effort, and with the co-operation of the sub-contractor for accident prevention.

DISCUSSION

Mr. O. R. Rietschlin (Aberthaw Construction Company, Boston): We have the same trouble that the speaker has. But we get over that by having a young engineer on this job, and he goes over the building twice a day. He follows the sub-contractors as well as anybody else. Each inspection takes ten to twenty minutes.

Chairman Woedtke: Mr. P. B. Easterbrooks, Field Superintendent of Dwight P. Robinson and Company, has written a paper for us from the point of view of the superintendent on the job. Unfortunately through some big work that he has on hand, he cannot be with us, but he has turned his paper over to Mr. D. D. Dick, Assistant Construction Superintendent of Dwight P. Robinson and Company.

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AN ACTUAL EXPERIENCE WITH A SAFETY ORGANIZATION ON A TYPICAL CONSTRUCTION JOB

P. B. Easterbrooks, Superintendent of Construction, Dwight P. Robinson and Company, Inc., New York City

Construction forces of Dwight P. Robinson and Company, Incorporated, started work on extensive improvements to the East Side Plant of the American Rolling Mill Company, at Middletown, Ohio, in July, 1919, and completed their job in April, 1921—twenty-two months later.

These betterments, costing over four million dollars, and requiring a field labor payroll alone of over a million and a quarter dollars, were carried out under the direction and supervision of the client's consulting engineer, Mr. Daniel Epplesheimer, who stimulated and encouraged our best efforts looking toward the safety of our men.

We were also materially benefited by the lively concern felt by the president of the American Rolling Mill Company, Mr. George M. Verity, in all matters affecting the welfare or happiness of our forces.

So at the outset it is probably best to call to your attention and emphasize the friendly and hospitable atmosphere in which the construction forces found themselves, for it immediately made available the most ıful assistance of the seasoned and wonderfully efficient Armco safety organization, whose operations and records are probably familiar to everyone interested in safety around industrial plants.

The Dwight P. Robinson construction forces at Middletown performed many hazardous operations without a man being killed or sustaining a permanent injury and with but very few lost time accidents. Moreover, the work was so conducted that not a single mishap occurred to any one of the three thousand plant operatives, who were carrying on production in the midst of the construction operations.

Results such as these could only have been obtained by co-operation of the most practical kind and by the kindly help and active assistance of every one down to the humblest employee engaged in and around the work.

Time and chance are large elements in all construction and it is only by obtaining such results as are recorded here that the construction superintendent is occasionally heartened with the enthusiasm so necessary and so essential to the growth of "Safety First."

Construction is essentially an adventurous occupation and numbers among its forces far more of the young and careless than are found among the steady reliable and efficient forces of the stabilized industrial plant.

SCOPE OF THE WORK

The betterments mentioned, consisted in the main of extensions to the sheet mill and furnace building, unloading and setting up of the machinery in the same, new buildings for the galvanizing and finishing departments, extending the boiler house and erecting new boilers, together with auxiliary equipment, extending the storage building, building a

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filter plant and new water softening tanks, installing a water cooling and return system together with spray pond for the open hearths, erecting a coal handling plant and distributing system for annealing and furnace building.

New 36" water main connections and valves were installed at the River Pumping Station, a new electrical distribution tunnel was carried from power house under the blooming and bar mill building to a new switch house. Extensive additions were made in electrical power and lighting distribution. Steam lines were extended to provide for new pickling machines and for other purposes.

Some of the quantities involved were as follows:

100,000 cubic yards of yard grading.
50,000 cubic yards of foundation excavation.
20,000 cubic yards of concrete were placed.
4,000 tons of steel were erected, riveted and painted.
2,500,000 brick were laid.
3 miles of new track were laid and nearly as much removed.
1 mile of new sewer was laid in deep trench.
1 mile of new road was built.

In general new buildings with a roof area of over ten acres were erected, together with all the machinery and necessary service and plant facilities which involved the unloading and placing in the work of over 2,500 loaded cars of material.

The able plant management was increasing production month by month (and without the use of new facilities) to a tonnage far in excess of best previous records.

To carry on construction work of this magnitude in the midst of an intense industrial campaign, so that each and every workman felt secure and confident in his safety, was no small achievement and shows what can be accomplished when large forces really co-operate intelligently. The client's consulting engineer, Mr. Epplesheimer, would outline and explain his construction program to the plant management and operating superintendents. After they had considered it and eliminated the objectionable features, it was then taken up with the construction superintendent, who would in turn take it up with his assistants and foremen and get their viewpoints of the obstacles to be met and overcome. It is a pleasure to record the fact that the construction forces were usually able to give the plant management the new work as desired on schedule time with no unnecessary hazards.

SAFETY ORGANIZATION OF CONSTRUCTION FORCES

After a week spent on the job getting acquainted with the assistant superintendents and the foremen of construction forces, and discussing plans for co-operating for safety with Mr. Adair, Safety Engineer of the American Rolling Mill Company, Mr. Davidson, Safety Engineer of Dwight P. Robinson and Company, Incorporated, outlined a scheme along lines developed by the members of the National Safety Council, which was both comprehensive and flexible enough to meet successfully all of the changing conditions afterwards encountered as the work progressed.

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A meeting of all the foremen was called by the superintendent at which the value of a safety organization was explained and the plan was launched on a working basis. The first step was the selection by the superintendent of three foremen for the first foremen's safety committee.

Two other committees of three each were formed from the ranks of the mechanics and construction laborers respectively, but they never did function properly, since they seemed to have no common ground for meeting, nor any general interest in the job. Moreover, with the terrific labor turnover obtaining throughout all industry at that period, often the men selected did not remain on the job for two pay-days in succession, or long enough to perpetuate the committee. After struggling with these conditions for a while, it was decided by the foremen to abandon the idea of any help from the rank and file and they agreed that it was up to them to make the job safe. This responsibility they assumed voluntarily and with few exceptions were at all times on guard against accidents.

The organization of the foremen's safety committee was designed to secure in turn the advice and active assistance of every foreman on the job. One member was made permanent chairman and the other two members each served four weeks as active committeemen. Every two weeks one man retired and the committee selected another from among their fellow foremen to serve. Thus, the personnel of the committee was constantly rotated by bringing in one new member at a time. At 2 p. m. each Tuesday, the safety committee made a thorough inspection of the job. Any conditions or practices which the committee deemed unsafe that were observed during the inspection of the job were immediately taken up and discussed with the foreman directly in charge of the particular operation, and appropriate remedial measures were recommended. All such recommendations were incorporated in an inspection report which was submitted at the fortnightly general safety meeting.

Every other Wednesday at 3 o'clock a general safety meeting was held in the field office, at which all superintendents, foremen and engineers were present. These meetings though short, usually lasting from forty-five minutes to one hour, were directly to the point and a good deal of business was transacted. A report was read showing the accidents, classified as to cause, which had happened since the previous meeting and a discussion carried on as to the best means to prevent a recurrence. Frequently, papers regarding safety were read by assistant superintendents and general foremen in charge of the various sections. Time was always set apart for a short round table discussion at which any one present brought up any particular accident problem that he might have on his mind. The inspection reports of the foremen's safety committee were also read and the different foremen concerned were questioned as to whether recommendations had been carried out. It is a notable fact that in but two instances was an appeal taken to the superintendent from the rulings and recommendation of the safety committee. We cite this to show the intelligence and spirit of fairness that actuated these foremen while temporarily in authority.

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The following recommendations selected at random from actual inspection reports of the foremen's safety committee are typical and illustrate the businesslike manner in which the committee handled its work. The names of foremen have been omitted in fairness to the men who so ably and cheerfully gave their time and experience to make this job safe.

Condition Observed	Recommendation to	Action Taken
Badly erected scaffold being used by bricklayers in testing room, galvanizing building.	John Doe. That scaffold be erected properly at once.	Proper scaffold erected next morning.
Ladders used by bricklayers working inside west wall finishing building erected in dangerous way. One leg buried in pile of gravel, the other mounted on brick pile.	John Doe. That ladders be erected properly with safe landing at foot.	Condition corrected same afternoon.
No bell sign on top of brick hoist north end of finishing building.	John Doe. That this sign be put up.	Sign installed same afternoon.
Columns E-36 and E-37 distributing building have less than six feet clearance from temporary track to annealing building.	John Doe. That columns be painted grey at once, and as requested on previous report.	Columns painted following day.
Man operating saw in finishing building without using guard.	John Doe. That as this practice is strictly against rules, man be reprimanded and that discharges be given if necessary to enforce rule.	Workmen reprimanded.
Protruding nails in scrap lumber on switch house job.	John Doe. That these nails be removed.	Commenced at once.
Nails in lumber new road work.	John Doe. That these be pulled.	Commenced at once.
Material for sheet mill excavation being piled too close to track.	John Doe. That this be kept back at least six feet form nearest rail.	Material moved following day and orders given that it be kept at proper distance in the future.
No railings around open pits old galvanizing building.	John Doe. That this be railed off.	Railing erected next morning.
Men using bull points in finishing building without goggles.	John Doe. That this practice be stopped at once.	Men sent to storeroom for goggles immediately.
Broken rung in ladder being used by the plumbers, open hearth building.	John Doe. That new rung be put in at once.	Ladder repaired at once.

The committee considers that a word of praise is due John Doe for the excellent job he is doing on the power tunnel under the blooming mill. No fault whatever could be found after a careful inspection of this work.

Foremen's Safety Committee
G. H. McGraw, Chairman.
O. L. Stone.
G. H. Nichols.

For one period of two weeks there were no unsafe conditions of any kind observed and on several occasions inspections were made and the whole job given a clean bill of health. Some of the foremen kept their names off lists for months, while others, on account of constantly changing personnel, found their names on every report for months.

But the foremen's safety committee with its inspection and reports every week and its meetings every two weeks did tie the whole job up

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to one standard of safety and by its weekly reports to the New York office kept alive and circulating the interest taken by them in this movement. This, together with frequent visits to the job by Mr. F. H. McGraw, construction manager, furnished the impulse necessary to carry the job over some particularly strenuous campaigns, where otherwise safety might have been relegated to the background and its importance perhaps lost forever.

The figures representing the accident experience on this work are as follows:

Accident Frequency Rate:

Number of lost time accidents per 100,000 man hours worked—3.3 (or 33 per 1,000,000 man hours).

Accident Severity Rate:

Number of working days lost per 1000 man hours worked—0.4.

These rates are calculated in accordance with the standard practice of the U. S. Bureau of Labor Statistics and the National Safety Council.

One of the outstanding features in connection with our safety work was the important consideration given by the foremen to the placing of a newly hired man. The care taken by some foremen in making a man appreciate the nature of the work to be undertaken, making him acquainted with his immediate associates and watching him carefully in places of possible danger, gave him a sense of security and a feeling that his personal welfare was being looked after, the value of which is hard to overestimate.

CONCLUSION

In concluding we quote from a report made by the chairman of the safety committee after the plan had been in operation about six months:

> "There has been a great change in the feeling among foremen toward the safety movement since its inauguration here. Many of us were openly dubious as to its success, but now every one takes a sincere interest in it and co-operates heartily with the safety committee, making suggestions and carefully safeguarding the men under them. Only by these methods can 'Safety First' succeed."

That the men themselves were alive to the safety movement, is best shown by the name given to the safety committee by one of the negro laborers, who called it the "do good committee."

Mr. Ellis (Boston): Was any physical examination made of the employees, and if so, were there any defects found?

Mr. D. D. Dick (Dwight P. Robinson and Company, New York City): There was no general examination of employees made. Of course anyone who showed a very apparent physical defect would be examined, and if he was not physically fit, he would not be employed.

Miss Townsend: Do you have a scheduled program for the men?

Mr. Dick: Occasionally there are a few things that may be discussed and the foreman may get a few of the men together and have a little talk, but there is no scheduled program of any kind.

Miss Townsend: Well, that is quite a hobby of mine. I interview the

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men every two weeks. I just take five minutes of their time, but usually it is on our own time.

MR. G. W. COOK (Travelers Insurance Company, Hartford, Conn.): It is a general experience that the workmen's committee is a failure. The foremen's committee is a success, and the success of this organization, as I see it, is in the fact that they got all the foremen together and reviewed the accidents which occurred. I do not know of anything, either in a contracting business or a factory, or in any kind of safety organization which will cut down accidents more than to bring the foremen together.

SECRETARY DAVIDSON: The fundamental idea in that plan, in my mind, is that there is no attempt made to introduce on the job a particular individual who is labeled the safety man, whose sole business it is to look out for safety, because that immediately relegates safety to a separate compartment.

MR. J. H. SCHULTS (James Stewart and Company, Inc., New York City): The foreman and the superintendent are the only ones we use on the safety committee. We have had very satisfactory results in all of our work.

MISS TOWNSEND: Our company tried a safety committee during the past year and it has been very satisfactory.

CHAIRMAN WOEDTKE: If there is no objection, we can now take up the report of the Statistical and Standardization Committee.

SECRETARY DAVIDSON: The Statistical and Standardization Committee, consisting of F. A. Davidson, Chairman, F. S. Robinson, and J. E. Griffith, begs to present its report.

This committee submitted last year their "report number one", which covered the proper method of collecting statistics and compiling accident frequency and accident severity rates. This report was adopted. At the same time a tentative report on accident classification by causes was drawn up by the committee merely to have something tangible to draw criticism, and the committee has now spent a whole year in getting this report number two in shape.

REPORT NUMBER TWO OF THE STATISTICAL AND STANDARDIZATION COMMITTEE ON THE SUBJECT OF A STANDARD LIST OF CAUSES FOR USE IN CLASSIFYING ACCIDENTS ON CONSTRUCTION WORK

I. As stated and explained in Report No. 1 of this Committee, the classification of accidents by causes is of the utmost importance because it brings to light conditions and practices requiring correction and serves as a guide for accident prevention measures. Accident prevention work is at present seriously handicapped by lack of adequate accident statistics. To illustrate the great service that can be rendered through the membership of this section compiling their accident records on a standard basis, the following is quoted from a letter to the chairman of

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the committee from the Honorable Ethelbert Stewart, Commissioner of Labor Statistics of the United States:

> "What we are hoping for is that the activities of the Construction Section of the National Safety Council will ultimately provide some information which will tend to fill the gap in our statistical data, which now exists so far as building construction is concerned."

II. The following list of causes is suggested as a standard list to be adopted by all members of the Construction Section in classifying their accidents as to causes:

1. MACHINERY AND EQUIPMENT
   a—Boilers and steam pressure apparatus
   b—Vehicles
   c—Hoisting apparatus
   d—All other
2. EXPLOSIVES, ELECTRICITY, FIRES, AND HOT SUBSTANCES
   a—Explosives
   b—Electricity
   c—Fires
   d—Hot substances
3. POISONOUS AND CORROSIVE SUBSTANCES
4. FALLS OF PERSONS
   a—From scaffolds and ladders
   b—From all other elevations
   c—Into excavations, floor openings, etc.
   d—On level
5. FALLING OBJECTS (Not being handled by injured)
   a—From elevations
   b—Cave-ins
   c—Collapses
   d—All other
6. HANDLING OF MATERIALS AND OBJECTS
   a—Wheelbarrows, concrete buggies, and similar hand carts
   b—All other
7. USING HAND TOOLS
8. STEPPING ON AND STRIKING AGAINST OBJECTS
   a—Nails
   b—All other
9. MISCELLANEOUS

III. The aim of the Committee has been to produce a list which will be sufficiently comprehensive to cover all the requirements of the average construction company and at the same time lend itself to comparison with the standard list of causes used in other industries. The Committee has carefully checked the list with the standards in use by the best known authorities engaged in the compiling of accident statistics and believes that tabulations obtained under this list can be directly compared with records obtained by other well known accident statistics gathering bodies like the U. S. Bureau of Labor Statistics, the National Workmen's Compensation Service Bureau, the International Association of Industrial

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A TABLE RECOMMENDED FOR TABULATING ACCIDENTS CLASSIFIED AS TO CAUSE.

Causes	Number of tabulatable or lost time accidents								Days lost due to						
	Total	Deaths	Perm. Total Disabilities	Perm. Partial Disabilities	Temporary Disabilities				Total Days Lost	Death	Perm. Total Disability	Perm. Partial Disability	Temporary Disabilities		
					Over 2 Weeks	1 to 2 Weeks	1 Week and Under						Over 2 Weeks	Over 1 to 2 Weeks	1 Week and Under
1. Machinery & Equpt.															
A. Boilers															
B. Vehicles															
C. Hoisting Appar.															
D. All Other.															
2. Explosive, Electricity															
Fires & Hot Substances															
A. Explosives															
B. Electricity															
C. Fires															
D. Hot Substances, Etc.															
Total															

Accident Boards and Commissions and the headquarters staff of the National Safety Council. It is believed that if any individual construction company finds that it is encountering a special type of accident regarding which it desires more specific information than this list would give as it stands, such a company could insert additional appropriate subclassifications under the main headings given, without in any way disturbing or going beyond the framework of the standard list.

IV.—NOTES REGARDING THE LIST. In general the Committee believes that the headings are sufficiently self-explanatory so that in most instances there will be little difficulty in classifying each accident in its proper place. However, there are some types of accidents where additional explanation is required, as for example, the question of properly classifying accidents resulting from flying particles. The test to apply with respect to "flying nails", "chips" and other particles, is to get back to the origin of the flying particles; i. e., chips, dust, sparks, and other particles set in motion by equipment or machinery should be charged under Class 1; chips, dust, sparks, and other particles set in motion by hand tools should be charged to Class 7; chips, dust, sparks, and other particles set in motion by some other cause that cannot be assigned to either of the above, should be charged to Class 9—Miscellaneous. Doubtless in actual practice numerous cases will arise where the individual company will find itself in doubt as to what classification to use for certain types of specific accidents. In this connection it is strongly urged that rather than be guided entirely by its own judgment, the individual company take

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up the question with the headquarters office of the National Safety Council, which will act as a clearing house in securing a uniform interpretation of the standards. This is extremely advisable in order to make certain that the various construction companies are following identically the same practice in the use of the list.

V. GENERAL COMMENTS. 1. Most accidents result from a combination of causes. However, it is agreed by competent authorities that for the purpose of classification, accidents should be ascribed to the immediate cause—that is "To that condition or circumstance, the absence of which would have prevented the accident; but, if there be more than one such condition or circumstance, then to the one most easily prevented."

2. The following example illustrates the above: A laborer wheeling a barrow down a poorly constructed runway stumbles near the foot of the runway, which causes him to fall against a concrete mixer in operation and he catches his hand in a set of unguarded gears on the mixer, which badly crushes his hand. Under the above ruling, the accident is charged to the unguarded gears on the mixer and is classified under heading 1-d. Had the machine been properly guarded, the man would not have sustained the injury which he did (a crushed hand) although it is possible he might have been otherwise injured by his fall.

VI. See attached table illustrating a suggested form for use in tabulating accidents as to causes.

The above report is respectfully submitted for consideration and adoption by the

STATISTICAL AND STANDARDIZATION COMMITTEE

F. A. DAVIDSON, Chairman, Dwight P. Robinson and Company, New York City
F. S. ROBINSON, General Builders' Association, Detroit, Mich.
J. E. GRIFFITH, New York City.

CHAIRMAN WOEDTKE: Who in the construction company should determine to which one of the nine subdivisions a lost time accident should be placed?

SECRETARY DAVIDSON: I think that the classifying of accidents should be done by one individual in the home office of each company. That individual should see to it that the reports which come from the job are sufficiently illuminating, so that he can classify intelligently.

(The report was adopted and it was voted that the officers of the section confer with the headquarters staff and have a safe practices pamphlet, covering reports numbers one and two, issued and distributed to the members of the Construction Section. It was also voted that the chairman revise to date or appoint an entirely new committee on codes for the Construction Section.)

CHAIRMAN WOEDTKE: I would now like to introduce to you Mr. Buchholz of the Associated General Contractors of America.

MR. BUCHHOLZ: I didn't come here with any definite speech. I came here rather to learn than to submit any definite plan. Like most associations we have always more work to do than we have funds to do it

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with, and we have been trying to devise some plan of doing safety work among our members, of which we have 1,100, without having to pay for it.

The contractors that are here represent only the large firms. Now, we have to look after the interests of what I call the average contractor —he is the little fellow—he is the man we want to reach, and is the hardest man to reach.

I know that it means money in the contractor's pocket if he adopts safety methods, principally because of insurance ratings. As far as I know now, speaking for the A. G. C., we would be foolish at this time to set up our own safety department when you have a going organization here.

Mr. Robinson made a suggestion this morning which might be the solution, and that is that if you can in some way put a man on selling membership in the National Safety Council among the contractors of the country, he could at the same time attend these community meetings and that would be his opportunity to sell the National Safety Council.

MR. W. F. AMES (McClintic-Marshall Construction Company, Pittsburgh, Pa.): As our time is getting very limited, I move that our officers be given power to take this matter up with the Executive Committee of the National Safety Council.

(The motion was carried.)

MR. ROBINSON: As I see it, this membership in the Construction Section of the National Safety Council is a most important thing. Mr. Buchholz has stated that they have 1,100 members. Every one of them should come in as members of this Construction Section.

MR. A. E. DAVIDSON: Mr. Chairman, when this section was started in St. Louis, I was appointed as chairman of the nominating committee, and we cast about to see whom we would put in as chairman of the section and we settled on you. I am sure that you will look back on your occupancy of this chair with the greatest of pride in the years to come. I am sure that the section was fortunate in having you as presiding officer. I would like to see before we retire a record, by resolution, perhaps, showing how the section appreciates the ability, efficiency, and splendid work that you have put into it.

SECRETARY DAVIDSON: I will be more than glad to entertain a motion to that effect.

MR. ROBINSON: I move you that a rising vote of thanks be given to the past officers of this section, particularly the chairman, for the very able manner in which they have conducted the affairs of this section, and that the motion be spread upon the minutes of the meeting.

(The motion was seconded and unanimously passed by a rising vote.)

CHAIRMAN WOEDTKE: I thank you, ladies and gentlemen, for your support and for all that you have said and done during the past four years, and I will simply ask you, in concluding, to give the same support, and more of it if you can possibly give it, to our new chairman. Mr. Davidson has been a right hand man all the way through the last four years to me, and I am sure that he is going to make an able captain of the ship.

ADJOURNMENT.

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Education Section

September 27, 1921

A. T. MOREY, Chairman
General Manager, Commonwealth Steel Company, Granite City, Ill.

DR. E. GEORGE PAYNE, Vice-Chairman
Principal, Harris Teachers' College, St. Louis

C. W. PRICE, Secretary
General Manager, National Safety Council, Chicago

MR. C. W. PRICE: One of the men who has possibly done more than any one of the state officials in making possible the Massachusetts No Accident Week is Dr. Payson Smith, Commissioner of Education; and I think it is very fitting that Dr. Smith should preside at this meeting. I take great pleasure in introducing Dr. Payson Smith as chairman of this session.

CHAIRMAN SMITH: I think that all of you who are superintendents of schools and who know something of my attitude in the matter will perhaps be able to appreciate something of the measure of my own interest in this proposition when I indicated my readiness to set aside at once my prejudice, which is perhaps more than a prejudice, against set drives and set weeks, in favor of this particular no accident week proposition. It seems to me that wherever there is any possible question as to whether or not we are going to be able by one device or another to prevent the increase of accidents, that the question always ought to be answered in favor of undertaking whatever offers any hope at all of the prevention of accidents, and particularly since we have been reading the figures and see to what a very large extent the school children of the state have been the victims of these accidents, it is quite clear that the schools have a very direct duty to perform and a very great responsibility to discharge.

I take it that the object of this week is in a way to focus the attention of the people upon this great subject of the prevention of accidents, but particularly perhaps to emphasize the value of human life. Of course, there will be no disagreement here, and I doubt if there is any disagreement anywhere with the statement that the institution that is represented here, the institution of the school, is the most important factor, the most important institution that we can possibly enlist in the preach-

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ing of this doctrine of the value of human life. The school itself is the greatest agency of conservation of any sort that we have, and certainly the conservation of life ought to stand very high among the purposes of education.

But we have not assembled here this morning to discuss the general idea with which we all agree or to lay down the general principle upon which we are all prepared to stand, but we have come here in order that we may, if possible, learn definitely some of the concrete specific things that we can do in our schools to help along this program. The people who are here represent 750,000 children, 600,000 and more in public schools, and 125,000 and more in private schools.

The first speaker is Dr. E. George Payne.

AN OUTLINE OF METHOD OF SAFETY INSTRUCTION IN PUBLIC PAROCHIAL SCHOOLS

DR. E. GEORGE PAYNE, PRINCIPAL, HARRIS TEACHERS' COLLEGE, ST. LOUIS

The fundamental essential of the plan that I want to present here this morning and which is to be discussed by those who are to follow me is that you are not to teach accident prevention as a separate subject. You are not to outline a list of topics that are to be given in one subject, but each subject of the curriculum is to devote its appropriate part to the elimination of accidents.

I do not know of any other subject for which public education exists than to develop controls in the individual children that will help them to meet life's problems more effectively than they would have met them if they had not attended school. Whatever those problems may be, whatever those situations in life may be, it seems to me the purpose of education is to give the individual greater power, greater control over his environment, to help him to shape his future, to make him a more effective citizen in the community and in the state. Whatever the subject is, it should lend itself to the achievement of those ends.

On the other hand, the material of accident prevention has a very stimulating effect upon the educational endeavor of any school room. We have found that the effect of such a vital motive arouses an interest in the work; that measured by the ordinary standards of achievements, the children learn more of arithmetic, learn more of geography, learn more of history, and learn more of English.

A teacher who has once begun to use accident prevention material in her instruction could not be induced to give up that material. The work is achieved with the minimum of supervision, because if a teacher is once committed to the problem, if she has once seen what splendid English work, what deep interest in arithmetic and in drawing and in all the subjects she can arouse by the use of the accident motive, you have no further trouble, because she will use it as much as it is possible to use it in stimulating interest in the regular subjects.

(Dr. Payne then described in detail the methods of safety instruction used in St. Louis, and the results secured; see Dr. Payne's addresses in

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Proceedings of the General Session on Public Safety and Education, page 33 of this volume, and 1920 Proceedings, pp. 200-202; 377-381; and 1073-1078.)

REPORTS ON PROGRESS OF SAFETY EDUCATION IN VARIOUS CITIES

CHAIRMAN SMITH: We are to have reports from a number of cities in this country wherein successful movements have been inaugurated and carried on for instruction in the public schools in the prevention of accidents.

Miss Harriet Beard, Supervisor of Safety Instruction for Detroit, will make a report for that city.

DETROIT

MISS BEARD: I should like to emphasize one phase of the work as it is developed in Detroit, and that is the fact that we have come to realize that the school part of the work is just one part; that we must work with all of the other agencies in the city, and that there must be unity and co-operation between them all. The co-operation that has developed in Detroit between the various civic agencies that are working for public safety I think is one of the best results of our work so far.

We have a very difficult traffic situation in Detroit, as all of the traffic is on one level. There are no subways, there is no elevated railway, and the streets converge like the spokes of a wheel in the central district of the city, so that it makes the traffic exceedingly heavy, and we have very serious problems there. And of course the nature of the industries and the number of automobiles adds to the difficulty.

The safety work in Detroit began about three years ago. This is the fourth year. At first a committee of teachers worked on this problem, but having other things to do, they found it very hard to spend the time and very hard to get material; so this is the third year now that we have had a paid supervisor who has devoted the entire time to the safety work in the schools.

The task of the safety department in Detroit has been fourfold. First of all, we had to study our own situation, see what the accidents were and how we could reach them, classify them by ages and by types, and get some information about what was actually going on. The police department furnishes us reports of all the accidents that happen to school children, and, in fact, children under school age, because we are trying to reach them, of course, by educating the older brothers and sisters.

Then from the vital statistics bureau we get information. I go there once a year and get the information for the preceding year. I have found some very startling things. For instance, I found that in 1920 we had fifty-one little babies under five burned or scalded to death in their own homes right in Detroit. And, by the way, I was quite interested to see how many people died of old age in Detroit in 1920, because I feel that old age is the only excusable cause for death. I searched a

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long, long time, and at the very end of all the causes of death, in a modest little corner I discovered that 68 persons in the city of Detroit died of old age. We do not have a chance to die of old age any more, because the automobiles or some other thing kill us before we arrive at that age.

The second task that we tried to perform was to organize a course of study that would be suited to our situation and to those various types of accident that we found are most prevalent, and find the needs of the children. I think that is a very necessary thing in this work. You must provide the teachers with materials. They do not have the time and they do not have the outlook on the subject to collect their own material, and they must be provided with certain topics and with certain information that they will endeavor to impart to the children. And that should be very simple, because, as you know, nowadays the curriculum is crowded, and the teachers are apt to look with disfavor upon anything that seems to imply a heavy addition to the work that they already carry. So the building up of a course of study has been our second task.

The third task has been to establish special activities in all of the schools. Now that is not forced on any school. If the schools wish to have safety clubs we are very glad to have them organize safety clubs, and we give them safety badges furnished by the public safety bureau of the city, and little metal buttons for the officers, that they like very much; and through safety clubs the children have an active part in the work. They have organized traffic guards and they have made traffic surveys of the school districts, all of these things of their own accord, and we are getting results in that way that we would not get if the work was forced upon the children or upon the teachers.

The biggest part of the work has been to give co-operation to the civic agencies—to the fire department, and the police department, and the Boy Scout movement, and the parochial schools. I am glad to say there is a very pleasant feeling in Detroit between the public schools and the parochial schools. They have taken our course of study and asked us to send them material. They send us interesting material that their children do. That has been one of the very pleasant outgrowths of the safety work in Detroit.

The police department has co-operated excellently with us, and we try to do the same with them. They send us a report of any accident that happens to any school child at any time of the day or night, and that report we send to the principal, and he is asked to return some explanation as to whether or not the child has had information or instruction to cover that particular type of accident. If we find the children have not had the information, we know that either the teacher has failed to impart the knowledge the child needs, or that the course of study fails to present what the child needs in that way.

POLICEMEN TALK IN SCHOOLS

Some policemen have been sent into the schools to see the children and talk with them, and the children like very much to see the officer

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in uniform come. The small boys, of course, are very much interested, and they get to know the policemen a great deal better.

Then this year we have inaugurated a system of talks by the fire department, and the board of mechanics went to considerable expense to make us a little fire alarm box that they could take into the schools to show the children how to turn in a fire alarm. With the small children they only speak about bonfires and matches, and with the older children they go into other hazards and speak a little more at length. Of course the children are very much fascinated by this practice, because the fire box is bright red and it has all the electric bells, cte.

The automobile club, the safety council, and the board of mechanics—all of these agencies co-operate with us; and the women's clubs have taken up the safety work. We give them a lesson once a week on home hazards, and they are giving us excellent co-operation, and we have a woman's safety organization that will take care of the things in the home. You remember those fifty-one babies that I told you were burned and scalded to death. We can only reach the babies through the mothers and the older brothers and sisters. All this co-operation that has resulted is very encouraging, and I think a very hopeful sign.

All of this work is on a service basis. If people want assistance, if they have a dangerous situation, thsy usually call me up and ask me if I can come out and see what they have to contend with; and I report that to the secretary or the deputy commissioner of the police department. We talk it over and decide what is the best thing to do and report back to the school. All of the different departments of the city work in that way. We have a sort of emergency organization so that we can call for help from one department to another and cut all the red tape that is usually involved in such things.

BOTH PUPILS AND TEACHERS LIKE SAFETY WORK

Now about the results. Of course the children like this work. They realize more than grown people sometimes how valuable it is to save human life, and they are very enthusiastic, and they develop all sorts of interesting things, and send the most unusual material. One school works it out in one way, and another school in another way; but all of our 156 schools are working on safety.

And the teachers like it very much. They find, especially in civics, that it gives the children the impetus that they need. And, by the way, we have only fifty per cent native white children in Detroit; we have 2 per cent colored children, and 48 per cent foreigners. And our big problem nowadays is to teach these boys and girls, the 48 per cent, to be good citizens.

I am going to give you the latest figures from Detroit. These figures relate to accidents to people in the city of all ages. The fatal traffic accidents from January to September 21 of this year were 88; that is little children and grown people together. We had 88 fatal accidents on the streets of Detroit in 1921, from the first of January to September 21, the day that I asked for the information; and last year for the same

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period we had 171. So you see during this year we are cutting down those accidents 50 per cent.

I called up the fire marshal and said, "Do you feel that we are really getting anywhere in this work we are doing?"

He said, "Indeed I do. We compile our records of fires every six months, and from January 1 to the end of June, the first six months of this year, we had a decrease of 465 in the number of fires compared to last year.

Now if that same decrease keeps up we ought to have at least a thousand less fires in Detroit this year than last.

I would like to suggest that from the work we are doing in Detroit we are impressed with the need of a few things. One is playgrounds. The children must play and if they haven't places in which to play safely they are going to play in the streets every time. And we must remember that this traffic problem has come to stay. It is going to be worse instead of better; and the children, I think should have an intelligent attitude toward the value of highways and the need of highways, and the need of the public using those highways intelligently and safely. Of course we need uniform traffic laws, and we need to have those laws enforced without prejudice. In Detroit we are improving very much, I think, in the enforcement of the traffic laws. It is much easier to get the conviction of a reckless driver now than it was some time ago.

Most of all, we need public opinion, and that is what we are working for, and the only way we can secure it is by the co-operation of all the agencies in the city. The school people alone cannot save lives; neither can the police department, nor the public safety bureau. It is only by working all together that we can bring about real results.

CHAIRMAN SMITH: For the city of Cleveland, Mr. A. D. Bixby, Superintendent of Public Schools, will make a report.

CLEVELAND

MR. BIXBY: Our experience in Cleveland has not extended over the length of time it has in St. Louis or in Detroit, but it has nevertheless been long enough to give us, I think, a feeling that we are actually attempting a work that is of extreme importance and also that we are upon the right track.

When this situation was brought officially to the attention of the superintendent of schools about a year ago, Mr. Jones, the superintendent, passed over the work to my department and asked me if I would investigate and see if I thought it was of importance enough to make it an official part of the school curriculum. I did that, and these are some of the things I found in the first part of the investigation.

I found that the need for safety instruction was felt and realized by the teachers; that this need was evidenced by the fact that sporadically they were doing work in the schools. A teacher here or there had worked out some scheme for taking care of the children on their way to school or on their way home. I found that this was not organized throughout the school system to any great extent, but because of the need and be-

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cause of the recognition of the need it was decided then to organize it in the schools of Cleveland.

With this in mind St. Louis was visited first, because it was felt that St. Louis was a pioneer in this work. And I want to say now that whatever we accomplish in Cleveland will be due in part at least to the help given us by Dr. Payne upon that visit. We found that his work was extremely well organized, that he had got far enough along the road to know what he was talking about and to be sure of the future and of the value of the course he was taking.

Detroit was visited. We found that Detroit had made progress, and we got valuable information from their experience.

We came home and began to investigate our own system, and to experiment. For instance, we found in one junior high school that a more or less serious accident was occurring about every six days. We instituted a plan of junior high school organization with the boys and girls themselves to look after the situation. This was the first of May last year. For the rest of the year there was not a serious accident. What did this prove? It proved to us conclusively that good can be done if organization is planned and followed up.

During the summer we completed a plan of the teachers, to be put into effect this year. We have got only as far as the kindergarten and the first six grades, but we hope to proceed to the junior and to the senior high schools. This little plan is not offered as the "be all and end of all" in safety instruction work in schools. It is simply the beginning that we are making.

A DEFINITE SAFETY AIM FOR EACH SCHOOL GRADE

Briefly, we have set a definite aim for each grade to accomplish, and those aims are what we think will be of interest, of course, to the children of that particular age. To go to school and to come home safely, the first grade, and so on through the fourth grade, the interest which lies in the field of civics. The fifth and sixth grade, organization work; that is, what we call junior safety council, where the boys and girls may themselves feel more responsibility in the organization of the school.

If any of you are thinking about working or beginning work in your schools, the period of investigation before you begin actual work is extremely important, because the problems in no two cities, it seems to me, are the same. They will vary with the size of the city, they will vary with the conditions in the city itself, the traffic conditions. Make your own investigation, keep your own records; then you will know where and how to begin.

CHAIRMAN SMITH: For the city of Syracuse, Mr. Frank Morris, the manager of the Syracuse Safety Council.

SYRACUSE

MR. MORRIS: The report that I have to make is quite different from what you have just listened to. The gentleman who just preceded me said that different conditions govern the plan that you must adopt in

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different cities. The city that I represent is a small city compared with Detroit, Cleveland or St. Louis, for we have only about 170,000 population.

I want to give a rather selfish viewpoint on this school safety proposition. Now I am a reformed industrial safety engineer, and I want to say to any industrial safety men who are present that the biggest work you can do is to go back home and start safety work in your schools, if you do not already have it. We have public safety, industrial safety, and school safety, and we think that the school safety is twice as good as the other two put together. Dr. Payne said yesterday in his talk that it is hard to teach an old dog new tricks. Well, he and I both have the secret of that. He did not tell you yesterday what the secret is, but I am going to let you in on that secret. Now this is the tenth annual congress of the National Safety Council, and he and I have already planned to go to the sixty-ninth, so you can figure it out for yourselves. The secret is this: The way to teach an old dog new tricks is to let him play with the pups. I know that from experience; and Dr. Payne, the president of the teachers' school in St. Louis, gives us a very fine report, but I think of Dr. Payne as one of us kids, because I have been down to St. Louis and I have met the rest of his family down there; and the reason he has been so successful in this work is not only because he is a thorough student but because he loves the little boys and girls. That is the secret.

We are trying to reach the men in industries, and the people who travel on the streets. How are you going to do it? The best way you can do it is through their children who are going to school. I have a letter on my desk now from a professor in the University of Syracuse, who said, "If it will be of any encouragement to you I want you to know that my wife and I are learning safety every day from our little girl who is going to grade school."

SAFETY JINGLES BY THE CHILDREN

We are always proud of our own family and we like to show off our own children, and therefore I feel that I must tell you of one or two things that the Syracuse children have contributed to the *Junior Safety News*, a little paper circulated through the junior safety councils in all the schools. There are thirteen such contributions published in one issue of this paper. I have some three or four hundred on my desk which are filed because we did not have room to print them.

"There was a young boy, his name was James;
He played with the fire and was caught in the flames.
He forgot to roll upon the floor,
And we never see him any more."

Again:

"Solomon Grundy, born on Sunday,
Forgot his safety and was run over on Monday.
His mother did cry, and his friends did sigh,
But to Solomon Grundy they had said goodbye."

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That was written by a little ten year old girl.

Again:

"There was an old fellow named Hodge;
He went out to ride in his Dodge.
Misjudging distance, he is out of existence—
Services were held by his lodge."

This was written by a 12 year old boy in one of the parochial schools.

"A parade to see craved Willie Jones,
He fell from a tree and broke his bones."

And here is one written by a 12 year old girl in which she refers to the A B C, which we all know means "Always Be Careful."

"Boy, corner.
Mother, mourner.
Sudden spill.
Doctor, pill.
Boy worse.
Flowers, hearse.
The A B C
Looks good to me."

Dr. Payne said that this work is training the child of today in the things the citizen has to handle, the concrete things the child is familiar with every day. I recall that the motto of the graduating class when I was graduated from high school was "Ready for Life." I dare say that that recalls to your minds something similar. This work, my friends, is making the child ready for life, our every-day life.

Now I will give you just one sentence, quoting from a letter written by an eleven year old girl in a parochial school. This is the final sentence in her letter: "I only hope that this organization will keep up its good work, so that our little brothers and sisters will have the advantage." After you get a letter like that you have got to keep going.

CHAIRMAN SMITH: For the city of Rochester, Mr. A. W. Koehler, the manager of the Rochester Safety Council.

ROCHESTER

MR. KOEHLER: The gentlemen who are directing the activities of the safety council of the city of Rochester feel that there is no more important work that could be done than instilling in the minds of the children the fundamentals of safety. Consequently we are devoting a large part of our efforts toward assisting the board of education, the teachers and principals, in every way that we can to further the interests of safety. To that end we had printed a little pamphlet which we are using as a text book for the pupils of the fifth, sixth, seventh and eighth grades.

Safety had been introduced into the schools of Rochester in 1915, and a junior safety council which was organized at that time had functioned for a while, but in time it ceased its activities. We succeeded in rejuvenating it, and it is now again working in a somewhat different man-

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ner, but we believe even more successfully than it has in the past. I shall confine my remarks to the Junior Safety League, as we have chosen to call it now, and tell you something of a safety campaign of the Public School Safety League which was conducted during the past school semester.

The pupils of the fifth, sixth, seventh and eighth grades were organized into what is known as the Junior Safety League. Each room is divided into teams, and each room elects a president, vice-president and secretary; and in turn the various schools form the Junior Safety Council. We got up this little book, and in it are sixty safety rules. Several of these are discussed each day by the teacher with the pupils, and on Friday an examination is conducted. The questions and answers have been so framed that the answers can be made very simple, in fact, can be answered in nearly every instance in a word. Points are given the children for correct answers. This provides for an individual point contest, a team contest, and a room contest. In addition to that, we have provided a little merit card, which is a little 3-inch by 5-inch card which slips conveniently into a youngster's pocket, and on that card we have printed something to this effect: "To whom it may concern: If you witness any act in the interest of safety performed by the holder of this card, please sign your name." That may be signed by anyone who should happen to witness anything that the youngster has done, or in the absence of an older person it may be signed by a youngster, who may use it when it is verified by his teacher.

HOW THE CHILDREN TEACH SAFETY TO THEIR ELDERS

We find that this has worked out very nicely, and we have had some very interesting reactions toward it. I want to cite just one or two to illustrate how it has gone home.

The manager of one of our public utilities, who has long been active in safety in the city of Rochester, told me of an incident that occurred in his own family. He said that he had been working in the garden, and without thinking allowed the rake to lie in an unsafe manner. It was called to his attention by his young son, who promptly called his father to task for allowing the rake to lie in that position. He showed him how easy it would be for somebody to step on it, or fall on it and be seriously hurt. Then after he had lectured his father he presented him with this little card and asked him to sign his name so that he could bear witness to the fact that he had taught him this lesson.

Not content with that, he went into the house, where he saw that his mother had left a basket of potatoes on the top cellar step. She had gone to the cellar to bring up some potatoes for supper, and thinking to save herself a trip had left this basket standing on the top step. The young son spied it and took it downstairs, came back and gave his mother a little talk on safety, presenting the card to her.

I might cite a number of such instances showing that it is being put over. It does make an impression, and the youngsters are very keen for

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it. That is functioning splendidly now in all the schools of the city of Rochester.

PLANT INSPECTIONS AND REPORTS BY CHILDREN

In addition to that, through the members of the Rochester Safety Council it is possible to arrange inspection trips for the members of the Junior Safety Council, so that the youngsters may see for themselves the way in which industry is protecting its workers. We sent them through a number of plants and told them to observe carefully the things they saw there and to report later. I wish that you might see some of the reports that we have from some of those children; they are exceedingly interesting. In every instance I sent copies of them back to the manager of the plant that had been visited, and received from him a letter expressing his delight at having received this little account of the experience of these youngsters.

Again, showing how seriously the children have taken the safety work that has been taught them, I want to cite the example of four mass meetings that were held during the Easter vacation. The children were away from school for several days, and we were having miserable weather at the time, but we had arranged to hold mass meetings in the assembly halls of four of the high schools. We provided safety films which appealed particularly to the children. We secured speakers, representatives of the department of public safety. We had a traffic officer; we had a fireman; the president of our council and I addressed another meeting. At each of these meetings we had well over a thousand youngsters. In spite of the fact that they were away and enjoying their vacation, they thought enough of the meeting to come there and listen. They were very attentive. On no occasion did we have to stop and ask them to be quiet, although some of the films were quite humorous. They laughed heartily, but immediately quieted down, so that we were able to put over our program.

Just a word about co-operation. We, too, are very happy in that we have splendid co-operation from our department of public safety, our chamber of commerce, our fire department and the police, and all others that are interested. We have only to suggest something that we should like to have from any one of them, and we have it without any further ado. I think that people generally are beginning to realize that in order to get over our safety teachings we must begin with the children in the schools; so that by the time they arrive at an age when they can go into industry it is no longer a problem to have them adopt the safety rules that they will find there.

Mr. Price: Let me tell you of an incident which occurred in Cincinnati. In the last eight months there they have organized ten thousand children as safety guards. Every one of those ten thousand children has passed an examination in twenty-three questions. Every one of them has taken a pledge not only to play safety himself but to warn others and save human life; and every one of them wears a safety button.

A few days ago, down in the poorer quarter, near the switch track, a

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little two year old boy toddled out onto the track. Suddenly, his mother saw that his foot was caught in the frog of the track, and then she saw a train was backing in on him. She lost control of herself and began screaming. A little boy, two hundred feet down the track, heard the screaming, ran up and grabbed the child, tearing the sole of the shoe off his foot, but saved him just in time.

Somebody asked him, "Joseph, how did you come to do that?"

He said, "I was down the track, and I heard that mother scream, and I thought that little boy was going to be killed, and I remembered I was a safety guard and I promised to save human life."

Now, if safety instruction can be instilled in the minds of the children like that, that sort of instruction is worth while.

ELECTION OF OFFICERS

The following were elected as officers of the Education Section to serve during the ensuing year:

Chairman: Arthur T. Morey, General Manager, Commonwealth Steel Company, Granite City, Ill.

Vice-Chairman: Dr. E. George Payne, President, Harris Teachers' College, St. Louis.

Secretary: Carl L. Smith, Manager, St. Louis Safety Council, St. Louis.

ADJOURNMENT.

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Electric Railway Section

September 27 and 28, 1921

J. H. MALLON, Chairman
Assistant General Superintendent of Transportation, The Metropolitan West Side Elevated Railway Company, Chicago

JAMES HARMON, Vice-Chairman
Manager, Safety Department, Kentucky Utilities Company, Louisville, Ky.

JOHN H. COX, Secretary
Adjuster, Cleveland Electric Railway, Cleveland, Ohio

TUESDAY MORNING SESSION

CHAIRMAN MALLON called the meeting to order and, after the reports of officers and committee chairmen were received and unanimously approved, Messrs. A. J. Van Brunt, J. H. Truett and J. A. Smith were appointed to serve as a nominating committee.

CHAIRMAN MALLON: It is now my privilege to introduce Miss Roadifer.

REJECTING THE GRUNDYS FROM SAFETY FIRST

MISS LAURA ROADIFER, PHILADELPHIA RAPID TRANSIT COMPANY, PHILADELPHIA

In this world problem of preventing needless injury to human life probably no other industry began earlier nor worked more persistently than the street railway industry, for the reason that upon its operations the city's economic life depends. With perhaps greater frequency, too, as a result of careful and continuous study of the material causes of accident, new and better improved safety devices have been put into operation to reduce the mechanical hazards to a minimum.

The street railway industry, more than any other, is confronted with ever-changing conditions involving new dangers and new problems. Contributing largely to these changes is the automobile traffic which shows such a marked increase every year, affecting some cities more than others, depending largely upon the width of the streets upon which we operate, that it unquestionably has become the greatest menace to safe street car operation. In my opinion the greatest problem which we have now to

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solve lies in discovering the best means of inculcating the "preventive spirit" in the minds of the general public, but principally directed to employees, autoists and school children playing in the streets; the latter being the particular phase of this problem to which I have been giving attention with very gratifying results.

Numerous methods to effect this "preventive spirit" have been employed, some more successfully than others, but most of us, at least until a comparatively recent time, have been prone to let our attempts in this direction rest upon the "Better be Safe than Sorry" type of slogan, which time and usage have robbed of their "punch," instead of attempting to arouse active spirit. By arousing a spirit of emulation among the employees, the inspiration for a clear accident record can be created and accentuated. Recognition of careful service ignites the spirit of emulation readily. One motorman of the Philadelphia Rapid Transit Company has operated a car for the last 20 years and holds a no accident record. His fellow workers know this is not merely a stroke of luck, but careful application to his duty at all times.

KNOWLEDGE OF HUMAN NATURE ESSENTIAL IN SAFETY EDUCATION WORK

A development of over-zealousness must be guarded against, however, for an industrial organization must have for its foundation co-operation for continuous mutual benefit, and it is very important that every individual in an organization should understand where the mutuality of interests lies. Unfortunately, however, the majority of accidents remaining in the street railway industry are caused largely by the public's failure to comply with the obvious laws of safety; for in this modern day of civilization the instinct of self-preservation is not so keen as in the more primitive ages, and safety teaching has become recognized as an essential part of everyone's education. It is a state requirement in some parts of the country that safety be taught in all the schools. I take it everyone here acts as instructor among either the employees in your organization, the public, or both, but regardless of the people whom you work among, the first essential is that you understand human nature well enough to intelligently select a method of approach which will bring the proper mental reaction.

Things regarded as educational do not have a strong appeal, generally speaking, for comparatively few of us have a natural thirst for knowledge. If this were not so, more men would rise from the ranks into executive positions than really do—if the interest to learn everything possible about one's job were prevalent.

Don't you think, however, that all of us are a little too inclined to regard ourselves as teachers, modifying our name somewhat by calling ourselves safety instructors or directors, but employing the methods used when we went to school, rather than regarding ourselves as salesmen of a product for which we must create a demand? The old-style teaching, the kind we had, won't "take" any more, and the modern teacher must apply the arts of the salesman to make his subject appear attractive, whether it is or not, and we must admit that safety is fundamentally unattractive.

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When you recall your old school days, a flood of the more pleasant memories arises first. You remember, perhaps, when you discovered first what the little ink-wells in your desks were for, when you spied the pig-tails of the little miss in front of you; or the thrill of excitement you felt when you let the little garter snake wriggle from your pocket to the floor; but—don't you remember what a joyless existence life became when you were made an example of before your small fellow men, just because you broke some sacred rule of the school-room; or the time that you were sent to the foot of the class because you could not recite, branded as the "stupidest boy," with the prediction you would probably find yourself through life at the foot of the class among men?

We have not changed so very much from the children we were; just better able to control our emotions and expressions; but we forget and become so terribly impressed with our own importance and take our work so very seriously that we go about burdened under the sorrows of the maimed and injured and become what I call the "Grundy" type, complaining of the everlasting carelessness of men; or the unwillingness of our superiors to see the conditions as they really exist; or go about deploring the fact that "someone" around the shop has done some very careless thing, and predicting as a consequence that that "someone" was going to get hurt if he isn't more careful; or announcing to someone before his fellow workers that that was the second time he had been caught without his goggles, and the next time it was expected he would be caught without his eyes.

THE "CONSTRUCTIVE" METHOD OF APPROACH BEST FOR SELLING SAFETY

Cheerful thoughts that suggest so many pleasant things. Let us eject the Grundys and adopt the constructive, happy methods of teaching or selling safety. We must avoid, however, going to the extreme in the other direction; for when a thing has been treated humorously it is difficult to prevent horse-play from entering into it, and it then immediately loses the dignity which this subject should always have.

However, it is a scientific law, regardless of the fact that it has been adopted in the doctrine of certain religious cults, that "that which we think and act and live we eventually become." We ourselves should think and live and radiate good health as a result of applying safety first, and encourage the thought of safety in the minds of the people we are trying to educate, rather than injure it as we do when we give them a mental picture of themselves maimed, or blind, or even dead. Instead of telling them to avoid injury so much of the time, let us try more to interest them with the right way to keep safe. Haven't you noticed how modern advertising, which is the greatest medium of salesmanship, features the happy, prosperous and joyful side of life; the old advertisements of insurance companies used to show the sorrow-stricken home with grim death hovering near; now they show the happy family grinning like a Cheshire cat because father's taken out an insurance policy. The "constructive" method apparently is the one that shows the good; why can't it be just as successfully employed in selling safety?

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Someone has asked me about the safety patrol work, and I realize it has not been described in detail before, and it has proved such a remarkable thing in Philadelphia that I would like to advocate it at this time. I have no hesitancy in telling you that in about fifty of the public schools in Philadelphia we have volunteer forces from the upper grades, boys 12, 13, and 14 years old, perhaps 10 or 15 in number depending on the dangers of the location of the school, and these boys act as traffic officers in their school neighborhood. They arrive at the school early and watch the ingress of the children to the school, help the little children across the street. They are dismissed a few minutes before the others are, and they take a position fifteen or twenty feet apart, with a captain at the crossing, who gives the signal to have the children pass. If there is no traffic officer there, as frequently is the case, the boy with the green arm band, with the words "Safety Patrol" and a button of which he is very proud, takes the responsibility himself of stopping traffic and letting the children through.

Of course one thing is to keep feeding the children new incentives. It is not a soft job to stand up there, and as soon as the novelty wears off they are apt to grow tired of it and there must be some new incentive furnished. At one time the children met in the Chamber of Commerce and became imbued with the idea that they were doing an important part of the city's work—suggestions were made, reports of dangerous localities were made, and an investigation group calling themselves the Junior Safety Committee of Philadelphia went about investigating various localities and making reports which were treated as they should be by the authorities, and I don't know how many signs there were erected in places of danger which were originally patrolled by the boys.

This year a series of posters was gotten up, one picturing an endorsement from President Harding, and the President wrote a very nice letter expressing a favorable opinion of the children's work which gave them an incentive to carry them along for weeks and months. It has proved the most effective of all the safety work done by the Philadelphia Rapid Transit Company. At the same time, the children's work acts as an advertising medium, for the children carry it home and the public realizes that there is an interest displayed in this humanitarian movement. It helps to create safety impulses and creates good-will, for the street railways generally speaking do not have too much good-will to spare.

DISCUSSION

R. B. Morley (Industrial Accident Prevention Association, Toronto, Canada): In Toronto we have run against the question of signs. The commissioner of public works there takes the attitude that if he were to plaster signs on every dangerous corner in the city there would be a forest of signs. I wonder how Miss Roadifer gets away with it.

Miss Roadifer: Probably the commissioner takes that attitude because there are so many dangerous localities! But we try in these reports to recommend the ones that are the most hazardous. For instance, three of our school buildings are large and accommodate approximately about

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1,000 students each, and they have in back of them a narrow street on which there is a garage. There is one exit from the school yard to this street, and many children take that short-cut toward home; and really the principal considers it not more dangerous to go out that way than out of the front street which is a traffic thoroughfare. But on account of this garage there are many strange people, not familiar with the neighborhood, who come out of the garage without sounding their horns, so a report was made to the department of public safety and they saw that the condition warranted a sign, and they put up "Blow your Horn".

And then in three other instances there was a slight grade in front of the school and that was an automobile thoroughfare used by people not familiar with the location; so they put up signs "School Ahead; Please Drive Slowly".

A detailed discussion concerning the future of the Electric Railway Section then followed and it was agreed that, among other things, the section should have at least one joint meeting with the Public Utilities Section each year.

ADJOURNMENT.

WEDNESDAY MORNING SESSION

CHAIRMAN MALLON: The first item of business is the report of the the nominating committee.

MR. J. H. TEUETT (Chairman of Nominating Commitee): The report of the nominating committee is as follows: Mr. B. D. Haskins for the position of chairman. Mr. Haskins is with the Chattanooga Street Railway Lines. Mr. H. B. Potter, for the position of vice-chairman. Mr. Potter is assistant general manager of the Boston Elevated Railway. Mr. M. W. Bridges, for the position of secretary. Mr. Bridges is safety engineer of the Metropolitan West Side Elevated, Chicago.

MR. C. B. SCOTT (Bureau of Safety, Chicago): I move that this report be accepted and these gentlemen declared elected. [The motion was seconded and carried unanimously.]

CHAIRMAN MALLON: The first paper to be given this morning is by Mr. Cullen.

THE ATTITUDE OF THE PUBLIC TOWARD THE RAILWAY'S PARTICIPATION IN NO-ACCIDENT WEEK CAMPAIGNS

JOHN E. CULLEN, UNITED RAILWAYS AND ELECTRIC COMPANY, BALTIMORE

I am assuming at the outset that no safety work which needs co-operation of the public can be successful unless the public is convinced of the sincerity of the public utilities' efforts to prevent the accidents. I am going to assume also that up until a short time ago there was an active and to a great extent inexcusable antagonism on the part of the public toward public utilities, and it had expression also against efforts by the

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utilities in safety work. Now let us trace the attitude of the public toward the public utility.

Way back in the horse car days when everybody could jump on the street cars without very much danger of an accident, it didn't make much difference. I remember as a child people coming back into the south from Boston and New York who used to tell the children how even the women in New York jumped onto the street cars drawn by horses. Then the accident problem was not great, neither was the problem of the attitude of the public toward the utilities. The antagonism toward the utilities started with the speeding up that came with the cable system, and as you remember the electric system followed certainly not more than three years after the cable. In a space of three years there was the transition from a method of transportation where you could almost walk upon the car to the period when if you attempted to jump on an electric car you would be hurt, and there came the time when children's legs were cut off when they were playing in the street—indeed one of my earliest recollections as a newspaper reporter was the terrible wail of a Jewish mother down in the slums of Baltimore when the legs of her child were cut off. And another recollection is the brutality and stupidity of the man who was sent out by the street railway to look into that accident and to attend to the details in connection with it.

Then came the planting of poles for the electric system. There again the public was touched in a tender spot. They objected to the ugly things in front of their houses where they were saving a small sum every week to buy the property. In Baltimore a woman took turns with her husband in sitting in the holes before poles could be placed there. Finally we get into the period of competition between groups of bankers who simply grabbed up one street after another for the purpose of holding the franchise, and the result was the public saw that these people were hogging the streets.

Then came the stand up period, and the hanging onto straps, and the period before regulation by bodies such as public service commissions when there was no doubt in the world but that the public utilities were not behaving right or doing the square thing by the public—and I say that as a public utility man; I cannot deny it because it is true.

When we got to the point of giving rapid service, you find an increased number of accidents of all descriptions. Then the lawyer got into the situation—the ambulance chaser—and made accidents out of occurrences that before would have been incidents.

MISSTATEMENT OF FACTS IS INJURIOUS

All this still would not have resulted in the tremendous antagonism of the public toward the street railways so far as accidents were concerned if it had not been for the way the average claim man or street railway official of any description had bungled the thing so. I remember at one time they had a pretty bad wreck on a railroad in Ohio and I was sent by the newspaper up to the office of the publicity man, and he told me there were five persons killed and about 102 or 103 lost in the woods—

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had wandered off, but that they were gradually rounding them up. I wrote up that story and very much to my discomfiture I found he had lied to me. The 102 people were killed.

Contrast that with this: On another railroad which runs out of Baltimore two trains had a head-on collision, and there were a great many persons killed and a still greater number injured. I went up to the station of that railroad with a chip on my shoulder because I expected the first railway official I saw would tell me there had been no wreck, or that the wreck was on the other road, or certainly if I asked how to get down there he would tell me the wrong way or that he would inform the conductor or motorman of the car not to let me in, or try to throw me off in some way.

I met the general manager whom I knew very slightly, and I told him I heard there was a wreck and I wanted to get down as soon as I could. He said, "I was just about to call you up. I have been waiting for you. I will send you down on a special car so you will get there as fast as you can," and so it happened that I was the only man that got the story from the engineer of that train. I had been treated so decently by that railroad that later I went down and testified and saved that company a great many dollars.

I cite these cases to illustrate the contrasting methods of persons in charge of claim departments, or departments of public utilities that have to do with the public through the medium of newspapers.

It has got into the minds of the people that the public utilities would rather speed up our railway systems, and save money by that, and take a part of that money for the payment of claims of persons injured, than spend a little to prevent accidents. This is absolutely a fallacy, because the more we speed up the more accidents and the ratio of money going out in claims is all against this fallacious proposition of speeding up and paying for the legs that you cut off. But it is an actual fact that the majority of people think, particularly in connection with electric roads, that we would rather do what I have just said than do the safe thing.

A short time ago we had an archaic law on the statute books of Baltimore forbidding us to cross intersecting streets at a greater rate than six miles an hour. We wanted that changed and wanted to go as fast as the automobile goes—certainly 15 miles an hour. We finally got it through, but only after a tremendous lot of trouble and stirring up a lot of antagonism. A former member of the city council got up at a meeting of the automobile club and deliberately charged the officers of our company with murder, because he thought that we had made up our minds to close our eyes to accidents.

NO ACCIDENT CAMPAIGNS PROVE TO PUBLIC SINCERITY OF COMPANY IN PROMOTING SAFETY

How are we to prove to the people that in all these safety efforts we are on the level? We know we are, because it costs less, and also because we are interested from the humanitarian standpoint, but how are we to

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prove it? First, be honest as to the accidents you have; don't kick cameras and camera men out of the office; don't lie to the newspaper men. There is nothing that a newspaper man appreciates more than having the truth told to him, and he will remember it the next time. Second, as evidence of your sincerity, and this is the main point of what I am trying to say this morning, participate in no-accident week campaigns such as is going on here and such as we just recently had in Baltimore!

I think that did us more good than anything else; it saved us a lot of money, and for every dollar we put into that campaign we got two dollars back. And more than that, the public said, "These fellows must be on the level in this idea of preventing accidents." Participation in campaigns of this kind is the greatest lever that you are going to have against that tremendous traditional opposition that people have had toward public utilities for a great many years.

We still have the responsibility of eliminating the share of automobile accidents that are our fault, but the community is beginning to find out that while we are doing our part, it is up to the automobilist to do his, and that can be worked out by establishing the right of way. In Baltimore the traffic police head has decided that an automobile containing two persons, or even five, is not entitled to the right of way, regardless of the laws, over a street car that contains 70 to 100 persons, so that the street car has the right of way at every intersection over everything. Where a motorman knows he is coming to a stop he simply gives the signal to the person in the automobile so that he can go along.

Here is the turning of the tide. We have a good opportunity to show that we are doing our best to prevent accidents, and that there are a great many accidents that occur as the result of automobiles which are not our fault at all.

DISCUSSION

CHAIRMAN MALLON: When I first started railroading a number of years ago, it was the practice of the officials to keep everything quiet and away from the public as much as possible. When we had a wreck, as Mr. Cullen said, a newspaper man was lucky if he was not kicked off the property; and if we damaged a car it was put out of sight so that nobody could find it.

About three years ago we had a very serious collision—rear end on a curve—and while it didn't inconvenience the public to a great extent, we were inconvenienced for a considerable time. Word came that a man from the *Tribune*, one of the principal newspapers, wanted to see me, and the representative of that paper was very much put out because the agent would not permit him to go up on the property, which was perfectly proper because the trolley was exposed. He said he wanted to take a picture, so I said all right and he set up his camera. He wanted to get the men in action and I placed the men around, and there were thirty or thirty-five pictures taken by newspaper men that day and evening. It was Saturday, and next day when the papers came out one of the steam roads was unfortunate enough to have a collision due to a fog, and they had a story of almost two columns about the railroad

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accident, and at the end we had about two inches. I attribute this small amount of publicity to the fact that we were willing and anxious to give them all the information they wanted.

MR. SCOTT: Early this year I accepted appointment on one of the national committees representing the electric railway industry and at the first meeting of this committee the subject, (almost in exact wording with the title of the paper) was considered and with the exception of myself and two other members, this committee took the position that no public utility should take a conspicuous place in the accident prevention efforts of a community, expressing as a reason for this idea the statement that such public utilities were subject to such public prejudice that leadership in community safety would suffer by reason of this odium.

It should not be necessary for me to say that I thoroughly disagree with the position assumed by that committee, and that I thoroughly agree and am pleased with the forcefulness with which the writer of the paper took a stand entirely opposite. I regret that as a whole the electric railways of this country are more delinquent in intelligent, active and helpful safety work than almost any other industry. I believe this statement is justified by such erroneous impressions as were conceived by the committee to which I refer, and by the small attendance at this meeting of the Electric Railway Section. If the electric railways had a proper interest in the safety of operation and in safety to the public this room would not be able to hold the delegation that should be here to assist in promoting safety in this industry. I know of no industry in which accident prevention is so absolutely essential as in yours. I know of an electric railway that is spending three million dollars a year for accidents that has no representative at this congress, and that road and many others which are spending a proportionate amount, will not spend ten thousand a year for the prevention of accidents.

The thought that electric railways should not be conspicuous in community safety work because of the prejudice attached to the industry, is not only wrong but extremely harmful to the properties and patrons. These utilities spend too much time worrying about the prejudiced public. The psychology of such a thing is harmful for just so long as this opinion is in the mind of the operators, just so long will the prejudice exist. The effect would be much better if the industry would forget this prejudice, which I am sure is largely imaginary. It is a mistake to draw an imaginary line between ourselves and the public. We are the public! If a citizen of any community should observe that the taxicab company or electric light company in his community had taken an advanced step in accident prevention, don't you know that he would say that it is a fine thing to do and that it would be a strong factor in establishing confidence on the part of the public in that taxicab or electric light company. I know of no single activity that an electric railway can undertake in the community served by it that is more commendable than to take the lead, the initiative and the direction of safety work and show to the public that it is sincerely backing up such work. We seek confidence and public respect, and we are sure to obtain it by such interest in the public welfare. How much better it is to take such a stand than

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to constantly talk about public prejudice and the necessity of our seeking the shadows of such movements. We are tied up with the public life and citizenship. We should be interested in every good thing for that citizenship and I know you will agree with me that we will bring to ourselves that respectability and proper recognition that is due us if we join hands with the public in such enterprises.

I am talking to the wrong group of electric railway representatives. The men who should know these facts are not here. The fact that you are present is evidence that your company is interested. It is a shame and a reflection on the electric railway industry that so few properties are represented in the attendance here.

MR. CULLEN: As an illustration of how that worked out in Baltimore, it so happened that the accident prevention campaign in Baltimore depended upon us—we really had to do the whole thing. About two weeks later the fire underwriters got together and said they wanted to have a fire prevention campaign, and they came down to our offices and said, "If you fellows will get behind us we know it will be a successful proposition." So you see if you get started on that sort of thing and back up every civic movement, you are not going to get in bad with the public.

MR. G. T. HELLMUTH (Chicago, North Shore and Milwaukee Railroad, Chicago): I would like to have you know our experience in Waukegan We were having what we thought were too many accidents there, and decided we would try to inaugurate a safety movement in the community. So we gave a lunch and invited all the public officials, the judges of the courts, the chief of police, the chief of the fire department, the mayor, and all the heads of business organizations. That was a practical way of forming the organization and they all came. Everybody was very enthusiastic. The mayor agreed to name a committee which would constitute the actual committee to carry on safety work at first. Our superintendent at Waukegan was selected as secretary. Then we held a meeting at the Chamber of Commerce, where they have a paid secretary. Our superintendent at Waukegan took the secretary of the Chamber of Commerce and one or two other of the active men to Milwaukee and showed them the workings of the Milwaukee branch of the National Safety Council. The men were tremendously impressed.

As a result, the Chamber of Commerce has taken on the activities of the movement. We attend all the meetings. It is known that we started it, and we are personally in touch with just that many more people and are well thought of. It cannot be looked at now as a selfish proposition.

ONE MAN SAFETY CARS HAVE FEWER ACCIDENTS THAN TWO-MAN CARS

MR. C. W. KELLOGG (Stone and Webster): I want to speak on the paradox of the safety car and the way the public feels regarding the one-man safety car.

The paradox is this: Anyone who knows anything about street railway operation knows that in the millions of car miles run there will be a great many accidents. They know in a general way that there have been two men on every car, a motorman to run the car, and a conductor to collect fares and do other things; and the ordinary person immediately

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concludes that because you take one man off the car, its operation cannot possibly be so safe as it was before, and the name "safety car" is a misnomer and misleading.

The one-man safety car was developed originally with the idea of securing economies in street railway operation. When the wages of employees increased so rapidly during the war, it was felt that the only way a reasonable rate of fare could be maintained was to have the work done by one man; and the people who originated this car, being experts in the street car business, realized that safety must be considered, and in order to meet it they designed a device which experience has shown can secure that safety.

The device consisted simply of an automatic controller handle to throw the power off as soon as the operator relaxed his attention. It throws off the power and throws on the brakes. This interlocking safety device also provided that the car cannot be started while the doors are open, and the doors cannot be opened until the car is brought to a stop.

I want to give some figures showing the results of carrying 246,000,000 passengers in one-man safety cars during 1920 on seventeen street railway companies in eleven different states. The total car miles operating was something in excess of 37,000,000 of which nearly 20,000,000 were with one-man cars and about 17,000,000 were two-man cars. This approximately equal division between the two kinds of cars makes possible a comparison of accident results. The total accidents for 10,000 one-man cars, 3.69; for the two-man cars, 5.20.

As to the cost of settling those accidents per 100,000 passengers carried. The cost was 9.6 less for accidents on the one-man cars, and the decrease in actual cost per 1,000 car miles was about 8 per cent.

There is a great deal more to be said on this subject, but as your time is short I will desist. I wanted to get on record what the one-man safety car showed, and to indicate to the public who do not believe it is safe that their belief is founded on a misunderstanding of just what the car ought to be. I don't think people realize the psychology of putting one man personally responsible for the whole operation. I do not think that all accidents with two men running the cars result from misunderstanding as to who will be responsible; but with the safety devices and limited responsibility the actual records show that the one-man car with those devices is safer than the two-man car.

CHAIRMAN MALLON: Our next paper will be presented by Mr. Messenger.

STANDARDIZING RAILROAD CROSSING SIGNS AND GRADE CROSSINGS

R. S. MESSENGER, CLAIM AGENT, ROCHESTER AND SYRACUSE RAILROAD, SYRACUSE, N. Y.

It has been my endeavor as a railroad man to look at this subject both from the viewpoint of the railroads and the public. If I am prejudiced or lean toward the railroad viewpoint it is because I ride so much on the

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head end of electric cars and see the consequences of the public's own recklessness, carelessness and thoughtlessness.

The ideal which everyone interested in this subject hopes to attain is the elimination of all grade crossings of railroads, both electric and steam, but that is not possible at this time.

Some time ago the American Electric Railway Association appointed from the Traffic and Transportation Division of the Association a committee to report on traffic regulations, and that committee has recently made a report in which the standardizing of crossing signs was taken up and the following resolutions adopted:

"Resolved, That this Committee express its approval of the present efforts to eliminate dangerous grade crossings and recommend that, so far as practicable, dangerous grade crossings be avoided in future construction and eliminated in existing construction.

"Pending the removal of such crossings the Committee recommends that the proper authorities be authorized to classify grade crossings as 'ordinary' and 'dangerous', and require the latter in addition to the standard grade crossing signs to be marked with uniform and conspicuous signs specifying the speed at which such crossings may be crossed, obedience to such speed restrictions to be required by law.

"Resolved, That recognizing the need for a uniform system of crossing signs, the United States Bureau of Standards be requested to make a study of such signs, including sign, color and arrangement of letters, height and location."

In this connection, I call your attention to Section 53-A of the Railroad Law of New York State which provides in substance that warning signs shall be located as nearly as practicable 300 feet from the crossing, on the right hand side of the highway approaching every grade crossing. The top of the sign to be not more than 5 feet and not less than 4 feet above the grade of the highway, the exact height and distance from the driveway to be so fixed that the sign shall be most readily illuminated by the headlights of approaching automobiles.

The New York sign consists of a metal disc 24 inches in diameter, with a white field, and a black border line one inch wide with black perpendicular and horizontal cross lines 2½ inches wide. In each of the upper quarterings shall appear in black the letter "R" 5 inches high, 3⅜ inches wide, lines one inch stroke. The reverse side of the disc to be colored black.

This sign is furnished by the railroad companies and set by the highway authorities of the town or municipality in which the crossings are located. You will find this sign at practically all of the grade crossings in New York State. This law is a step in the right direction, but I do not believe that the sign is sufficiently conspicuous to be adopted as a standard for all crossings; also there is nothing in the law to prohibit other signs being placed at crossings.

MULTIPLICITY OF SIGNS WORSE THAN NO SIGNS

You have all approached crossings where there was the usual "Stop, Look and Listen" sign, a sign similar to the one mentioned in the New

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York law, a sign put up by the state highway departments, a sign put up by the local automobile club, and last but not least a sign put up by some industrial concern, ostensibly a warning sign but in reality an advertising scheme. This multiplicity of signs is, in my opinion, worse than no sign at all, because when the driver of a vehicle approaches a crossing so decorated he tries to read them all and doesn't sense any of them or what is more apt to happen, they are taken for advertising. If one conspicuous uniform sign was placed at each crossing and the public seeing that sign could know that it meant but one thing, many crossing accidents would be avoided.

The great increase in automobiles has made such a radical change in the character of the travel on our highways and has been accompanied by such a startling increase in the number of grade crossing accidents that we are called upon to carefully reconsider our present methods of crossing protection and to devise, if possible, new and more effective means of protection, also to make every effort to inform and educate both the railroad employees and the public, as to the dangers from these causes and the best means of minimizing those dangers.

UNIFORM SIGN SHOULD BE ADOPTED EVERYWHERE

A uniform standard sign of such size and coloring and so lettered that its meaning cannot be mistaken should be placed at every grade crossing in the country. Such signs should be placed at a uniform distance and far enough from the crossing so that there will be plenty of opportunity to have an automobile under control before reaching the crossing. When such a sign is adopted and placed, which should be soon, it should be prima facie evidence of negligence on the part of the driver of a vehicle who is struck and injured at a grade crossing.

In a recent talk with the chief safety officer of one of the largest railroads in the country, he told me that he had sent out three men with assistants to check three widely separated crossings for the purpose of finding out the number of vehicles going over those crossings in a day, and also for the purpose of checking the number of drivers of such vehicles who stopped, looked or listened before crossing the railroad tracks. Approximately 7,900 vehicles crossed the three crossings on that day, 98 per cent of which were automobiles, but the astounding result of the checking was that none of them stopped, and slightly less than 5 per cent looked or listened before crossing the tracks of his company. Gentlemen, the railroads of this country are spending thousands of dollars every year to protect the public and make safe their grade crossings, to train and educate the motormen and engineers in safe operation, but until the automobiling public shows a disposition to co-operate, we are going to continue to have these appalling catastrophes at grade crossings, no matter what type of sign is adopted as standard.

Gates and flagmen are considered by many as the most effective protection for grade crossings, but the expense of maintenance is greater than the electric railways of this country can stand. Aside from the expense I personally know of numerous instances where automobiles have been

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driven through the gates. I recall one place where this is of frequent occurrence. In the August number of the *National Safety News* there was an illustrated article showing where the Long Island Railroad have been compelled to use telegraph poles in place of the usual type of gates because so many drivers of automobiles had driven through the ordinary gates. This is pretty good evidence that the fault is not all with the railroads.

Pedestrians are daily disregarding the gates, walking under or around and being struck by approaching cars.

Flagmen are human, and where the human element enters, failure sometimes arises, but more often in the case of railroad flagmen than elsewhere because cripples and old men are placed at crossings as a substitute for a pension. This should not be done, for a flagman to be efficient must be intelligent, active and alert.

There are many automatic signals for crossings such as electrically operated gongs, good at some places, but affected by climatic conditions, easily getting out of order, or else they ring continually when there is no danger, which leads to their utter disregard.

The old type "Stop, Look and Listen" signs were all right before the advent of automobiles, when the approach to crossings was at the rate of four to eight miles per hour, but in the present day these are not conspicuous enough, nor are they seen soon enough to stop a vehicle approaching a crossing at twenty to fifty miles per hour, so today we are advocating a standard crossing sign to be placed at from 300 to 500 feet on each side of every crossing.

In New York State, and I am informed in many other states, the railroads are compelled to pay for these signs. It does not seem reasonable to require the railroads to furnish or maintain crossing signs to be erected off their right of way. This should be a public charge or at least the cost of the signs should be shared by the public, and the signs placed and maintained entirely by the public.

As to the maintenance of these crossing signs, I have seen any number of them that have been placed at crossings in New York State within the last year, riddled with bullet holes, the enamel knocked off, the sign bent so as to be useless as a warning and in many instances knocked down entirely. Much of this damage is done thoughtlessly by boys, some deliberately by grown men.

The National Safety Council should, through its local councils start a campaign to educate the public as to the meaning and importance of the standard crossing signs and as to the possible results which may arise from their effacement and destruction.

DIFFICULTIES OF CLEARING VIEW AT CROSSINGS

To the railroad man grade crossings present another problem, which is to make the view for the motorman and the driver of approaching vehicles as long and as clear as possible. Here again the railroad company meets the opposition of the thoughtless public who own property along its right of way. For example, the company with which I am

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associated, has for the past four years sent out men to trim trees and clear the view at all crossings on our road, which is a double track, high speed road, 87 miles long, operated, between the cities of Syracuse and Rochester, over 117 grade crossings. As foreman of this safety crew we use a motorman who has been in the employ of the company for the past fourteen years. His instructions are to trim all trees, bushes and weeds on the right of way which in any way interfere with or obstruct the view of a motorman or the driver of an approaching vehicle; also to trim all trees, etc., adjoining the right of way that interfere with or shorten the view, where he can obtain the permission of the owners of such trees or bushes. Here is where the trouble begins. The one idea in the minds of adjoining property owners, particularly near cities and towns, is to grow a hedge or line of trees that will shut off the railroad regardless of the safety of the public at such grade crossings. We have no power to compel the trimming or to prevent the planting of these barriers, but are annually forced to pay out large sums of money for accidents caused by these death traps erected by unthinking people.

All railroad grade crossings should have easy approaches, good planking and be so graded that the danger of stalling motors would be eliminated as far as possible. All automobiles should be driven over railroad crossings in intermediate gear to further eliminate such stalling and save many accidents.

Slight inexpensive changes in highways often make dangerous crossings comparatively safe. When a road crosses two or three times within a short distance, several crossings can be eliminated by relocating the highway especially when state or county highways are being constructed.

Among the safety rules of the road with which I am connected, is an order to the motorman that all highway crossings in cities and villages must be approached under such control that their car may be stopped short of any obstacle. Some time ago at one of these crossings an automobile was pushed between 200 and 300 feet. The motorman was laid off for 30 days. The situation has improved since then, but there again we have the human element and it is necessary to constantly check up these crossings to see that the order mentioned is obeyed, but who checks up the careless, thoughtless, reckless automobile driver for whose mistakes the railroads are daily made to pay.

IGNORANCE OF PUBLIC AS TO MECHANICAL EXIGENCIES OF INTERURBAN CARS RESPONSIBLE FOR MANY ACCIDENTS

Many grade crossing accidents on electric roads, in my opinion, are due to ignorance on the part of the public as to the speed, distance traveled per second, and distance in which a large interurban car can be stopped. Not long ago a vehicle was struck at a crossing on one of the roads running out of Syracuse. The following morning the coroner asked to talk with the motorman who was a man of long service. The claim agent called the motorman into his office and asked the coroner if he would like to question him. The first question asked was the speed at which car was traveling when vehicle was first seen. The mo-

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torman's estimate was 40 to 50 miles per hour. "How far away were you from crossing when you first saw vehicle?" the coroner asked. "About 200 to 250 feet," was the reply. "How far did you go after you applied your air before stopping?" "About 650 feet." At this reply the coroner said "That is all I want from you. You should have stopped in less than that distance."

After the motorman had left, the claim agent told the coroner that a test was to be made the following day with the same car and motorman at the point of the accident. The coroner said he would like to be present.

The following morning the coroner, first examining the brakes and car, went out on the line. A number of tests were made and the shortest stop according to the coroner's own measurement was about 700 feet. The coroner went back to the company's office and told the claim agent that he wanted to see that motorman and apologize to him, as he considered, after seeing the test, that a wonderful stop had been made at the time of the accident. He also said that he had learned a great deal about the operation of interurban electric cars that he had not before appreciated. That particular coroner is very careful since that experience about placing the blame before he knows all the facts.

My observation has been that the officials in charge of constructing state and county highways pay too little attention to safety features at electric railroad crossings. I know of a number of roads constructed within the past few years where the crossings are diagonal, a good view one way and no view the other for either the public or railroad employees. Cuts have been dug, the grade changed and no attempt made on the part of the highway officials to eliminate resulting banks obstructing the view. Many of the crossings were formerly on little used dirt roads, but as soon as they are made state or county highways they become popular routes for automobiles and the travel on them is many times what it formerly was, increasing greatly the hazard to the public and the railroad companies.

"TRACTION ORANGE" BEST COLOR FOR STANDARD CROSSING SIGNS

The railroads, the state and county highway authorities, automobile associations and local safety councils should get together in every state in the union and adopt some sane, uniform and practical method of road construction in relation to grade crossings.

It is my opinion that the standard crossing sign should be of a color that is most visible in daylight and will most readily reflect light from automobile headlights, and even from a dim lantern on a farmer's wagon, and that color from my experience should be "traction orange" for the background or field, with "Railroad Crossing" in large black letters. It should be of such size as to compel the notice of passing vehicle drivers, at least 4 feet by 4 feet, and should be constructed of a material as nearly indestructible as possible. This sign should be located on the right hand side of the highway on each side of every crossing at a distance of not less than 300 feet. All other signs should be prohibited by law from being placed within 1,500 feet of such grade crossings.

Some may wonder why "traction orange" has been my choice. The

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cars of the company with which I am connected were formerly painted a dark green and some a Pullman color. One day I heard one of the public service commissioners of New York State say that our cars blended too much with the landscape and should be painted a more visible color. This was immediately taken up by our company and a study made by taking one car, painting it in panels several different colors. We found after an exhaustive test that the "traction orange" was visible at a greater distance and reflected light farther than any other color.

"Traction orange" is a shade of yellow. Yellow is the color that is used by railroads as a caution sign. Caution is the thing that must be instilled in the minds of the people approaching railroad crossings. If the public will approach grade crossings with caution there is no danger and therefore, no need for a red sign. When it becomes a habit with the public to approach grade crossings with caution, the grade crossing problem will be near solution.

CHAIRMAN MALLON: We have on our properties a large number of crossings for the length of the road, and we really have more accidents where we have gate protection than where we have none.

We are installing now a new device which we have tried out, but which is not yet perfected. It is in the form of a gate or barrier electrically operated. We have four large columns or posts on each corner of the street with big chains that are counter-balanced and which operate up and down in each one of those columns. Those chains are connected to a heavy mesh that goes across the street on either side. When those are down they stand about five feet from the street, and an automobile running into it will drive it forward. It is sufficiently far away from the track so it cannot go far enough to run into a passenger train, and by the time the momentum of the automobile is lost these big counterweights will push the mesh back again.

We made a couple of tests and found by running into this mesh that we broke it at a speed of 40 miles an hour; so we have got to devise a different kind of chain, and may have to substitute a cable.

ADJOURNMENT

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Employees' Benefit Associations Luncheon

September 29, 1921

GEORGE T. FONDA, Chairman
Manager, Safety and Compensation Division, Bethlehem Steel Company, Bethlehem, Pa.

CHAIRMAN FONDA: The idea in having a meeting of this sort is mainly to swap experiences. During this period of depression we have had a rather peculiar experience, in that our system depends somewhat on labor turnover—and, of course, there has been no such animal for the past year or two. This has affected the amount of revenue that has been available previously from new members. The first topic offered for discussion is "Best Methods of Obtaining and Maintaining Membership."

I think it would be well to bring out the two general methods: compulsory membership in relief associations, voluntary membership in such associations, where things are run in accordance with the desire of the employees, and no particular pressure is brought to bear on their becoming members. In our case we believe in compulsory membership, and when a man is hired, he must become a member of our association. We feel that the cost to him is very little when you consider what he receives. The maximum cost to him is 60 cents initiation fee and 40 cents a month dues. He gets $8 a week benefit. In case of his death, his family receives a death benefit of $100. If his wife should die, he gets $50. In case of the death of a child within the age limits, he gets $25.

We know that so far as the weekly benefits are concerned that it has been a great thing for the class of employee who would not accept this thing, perhaps, unless he was compelled to be a member of this association.

Our charity associations in different localities tell us that in many instances if it hadn't been for the money received from the association in case of sickness, employees' families would have been practically destitute. We therefore feel that perhaps the pressure we put upon the new employee to become a member is a good thing because of what he gets out of it.

On the other hand, in some of the properties that have been taken up by the Bethlehem organization within the last five years, associations were started there voluntarily and memberships solicited by simply

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presenting the facts to the men and telling them that they could, or needn't join these associations, as they saw fit. We made this proposition to them: if they would join within a twenty or thirty day period, we would consider their entire employment with the company as their membership in the association.

That had this little kick in it: if a man's whole employment record was considered as his membership in the relief association; five years' employment record meant that he was entitled to a whole year's benefits, in case of a total incapacity; ten years meant two years' benefits; fifteen meant three, and over fifteen, four. We gave those men the option of joining within thirty days and having their employment records stand as their membership records in the association. The men saw the value of what we were offering and practically all of the men in those newer plants took advantage of it. From 92 to 96 per cent of the total working force joined.

GIVE THEM FACTS AND THEY WILL JOIN THE ASSOCIATION

As you men know, there are always some fellows in the plant who think there is a "nigger in the wood-pile" somewhere. No matter what sort of a proposition you work out for their benefit, they are dubious and talk against it. I had one experience in a very small unit down in Baltimore where there were only about 200 men in a machine shop. Practically none of the men had taken advantage of this thing or declared their intention of becoming members. The general manager was a little bit worried about it, because he knew that there were two men who were chronic kickers and they had created the misunderstanding in the minds of the men. We suddenly staged a meeting one day. We posted a notice about 11 o'clock. We called these fellows together and told them, "If you have any questions, let us have them." We stated the case, and that afternoon every single man in the shop signed a card.

This simply shows that if you go out and give the fellows the facts, roll up your sleeves and show them that there is nothing concealed, it works. Therefore, I think that compulsion in this sort of thing is the answer. I think that it does more good than to let the thing drift along and obtain voluntary membership—although in cases where we allowed the men to join on their own hook, practically all of them did so.

MR. J. B. DOUGLAS (United Gas Improvement Company, Philadelphia): These benefit payments take the place of all salary or wage payments that a man ordinarily would receive if he had been with the employer for some time, in case he gets sick?

CHAIRMAN FONDA: If he is a wage employee on an hourly basis, he of course stops receiving pay when he stops work. In the case of salaried employees and some semi-monthly employees, in most instances there is no stoppage of pay. In special cases some allowances are made but, generally speaking, the pay stops for the men working on hourly and daily rates.

MR. DOUGLAS: In organizing an association in Philadelphia, I struck several rocks. One of the big rocks was a statement by some men who had been old employees and who, when injured or ill, were paid wages

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more than the compensation law allowed, or more than the association benefits would mean. They said that if they joined, it would simply mean that they would no longer receive full salary or part salary in case of illness, as in the past.

Of course you can argue against that, but the general trend, where there is a benefit association, is to limit the time an old employee will receive full salary. The men, of course, prefer full salary to the weekly benefit.

I also would like to ask if this is an insurance proposition, or if you carry the risk yourself?

CHAIRMAN FONDA: We cary the risk ourselves.

MR. DOUGLAS: Did you meet the same question that I met, in organizing your association?

CHAIRMAN FONDA: No. Salaried men belong to the association to a large extent. With them it is a voluntary proposition, and periodically we approach the heads of the divisions of salaried men and take a recanvass.

MR. DOUGLAS: I understood you to say that it was compulsory, and I interpreted that to mean that every employee would have to join. The trouble that I mentioned was with the salaried men. There is no question at all with the wage earners.

MR. H. A. LEY (Fred T. Ley and Company, Inc., Springfield, Mass.): We have a rule that the firm will make up the difference between what the association pays them, and what they would get for salaries, but we made this reservation: that it is optional for anyone to join or not to join, but if a person elects to carry that benefit himself, then we feel free not to pay that person when he is sick.

CHAIRMAN FONDA: Of course your company always reserves the right to withdraw that arrangement of paying a man a part of his salary in case of disability; and in a number of instances, I think it is a question of circumstances.

MR. LEY: I think every person owes it to himself and to his job to do what he can to keep on his job, and the question of what happens to him when he dies is something that every person should look into.

I think you must make those things optional. But if you let it be optional with them, then if they decide that they do not want to join the association, you must let them suffer.

MR. DOUGLAS: I understand that Mr. Fisher over there is connected with one of the most progressive associations.

CHAIRMAN FONDA: Is membership compulsory in your association?

MR. BOYD FISHER (Lockwood, Greene and Company, Boston): No. We don't believe in compulsion. We have a membership of 80 per cent and we hold that very closely. We have various benefits, much the same as all others. Of course the benefit is entirely proportionate to what you pay. We got our membership and held it, by getting the foremen sold on the proposition; they sell it to the new employees.

The question of monthly men is taken care of in this way: the monthly man is expected to belong, and the management makes up the difference

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between what the association pays him and what his salary is. If he is not a member, why he loses that portion.

MR. J. A. NORTHWOOD (Cambria Steel Company, Johnstown, Pa.): With our men in the employment office, it is compulsory, but with our salaried men it is optional. Yet 85 or 90 per cent are members.

If a salaried man is sick, he gets his salary just the same—that is absolutely the company's end of it. But he also gets his relief benefit. just as from any outside insurance company.

MR. LEO D. WOEDTKE (Fred T. Ley and Company, Inc., Springfield, Mass.): Mr. Fisher, did I understand you to say that in the event the salaried employee does not join your association and is incapacitated, you pay him the difference between his regular wage and what he would get from the association?

MR. FISHER: Let me answer it in this way: The management has for a great many years had a sort of unwritten rule that a man who is paid by the association will be cared for an indefinite time, such as the management may determine, in case of injury or sickness, regardless of the compensation law.

I don't know of any case where that has been stopped when a man has been sick. I know of men who have been cared for six months in a year.

Now if this man is not a member of the benevolent association, he will receive his full salary, less what the association would pay. If he is a member, the association pays its part and the management makes up the difference between his salary and what the association has paid him, and so he gets his full pay. Our organization has a death benefit feature which we buy from a standard insurance company, and the company contributes half of the expense.

CHAIRMAN FONDA: The question may come up in some of your minds, what real object would there be for a salaried employee to be a member of the association? In our case it is more or less a question of example.

SALARIED MEN JOIN FOR EFFECT OF EXAMPLE TO WAGE WORKERS

Our general superintendent at the Bethlehem Plant, for instance, in talking to some of the men not long ago, told them that while all of those fellows there were not affected in case of sickness and they got their salaries just the same, that in case of sickness they would get this additional amount. That amount wasn't very much, but at the same time, he wanted the men in the plant to know that their boss was a member of the relief association and paid his dues just the same as they were expected to do. Mr. Lewis, the general superintendent of this particular plant, as a matter of fact, is a member of the association. So are all our vice-presidents members. Mr. Grace, president of the company, is himself a member.

That is simply a matter of example, that is all. It has been put up to the salaried man in that way—that is, the leading salaried men. We don't deduct from the salaries of these men the $8 a week that they get from the relief association in case of disability. I think that more than

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90 per cent of all salaried men in our company are members of the relief association, simply because it has been put up to them with that kind of argument.

MR. WOEDTKE: What are your reasons for compulsory methods?

CHAIRMAN FONDA: We feel the value of having the rank and file members of our association. In cases where membership is not compulsory, it was said 80 per cent of the men are members. There is 20 per cent who are not members of the association.

THOSE WHO NEED BENEFITS MOST ARE LIKELY TO STAY OUT

I argue that that 20 per cent who are not members, are probably the men who need the benefits of the association most. You will find that, in the steel business, they would probably be your foreign labor, or certain particular kinds of foreign labor, and that in case of sickness they would be the very people that need this help most. It is because of their inability to understand English and a number of other different things that they don't know enough to become members of the association. When they become sick, they appreciate this loss. It is to reach this 20 per cent, that your compulsory membership is necessary.

MR. WOEDTKE: Mr. Fisher, what benefit do you get on non-compulsion?

MR. FISHER: It happens that most of those who are non-members of our association are old employees who are in good circumstances. We have quite a few of these in the executive class.

It is proper to state here that there is a distinction between a salaried man and a man on straight weekly or hourly time to this extent: in any business a salaried man is presumed to be a part of the management, and if he doesn't care enough about our schemes to increase production and efficiency, he isn't really in the game with the other fellows. That is why we dock him if he doesn't play the game with us.

Now, on the compulsion end, we feel that that is an employee's business. That is our sentiment in the matter. We furnish the medium, we go to him personally with the thing that we have to sell, we tell him it is the cheapest insurance that he can get, and we then let him decide for himself whether he wants to join the association or not. There is a death benefit of $1,000 in connection with it—that is another argument for the salaried employee—at a cheaper rate than he can get any place else. He also has the privilege of taking $2,500 additional on a term basis on a cheap contract that we couldn't duplicate today.

CHAIRMAN FONDA: I think the thing varies with the personnel of your plant. I don't think that the same rule would apply in all classes of industry. The steel industry, the textiles, rubber, and cement have a different class of employees. Public utilities would have still another class to deal with.

MR. WILLS MACLACHLAN (Consulting Engineer, Toronto, Canada): Might I ask for an experience where salaried employees compose the greater percentage of the total number of employees? That is the case with public utilities.

MR. FISHER: I represent public utilities, and in my own organization we don't have a great majority on the salary basis. Our monthly payroll

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is very much smaller, both in numbers and in amount. The advantage of membership for salaried men is the cheap insurance and the stimulation of the business through which a man profits by increased responsibility and increased compensation.

CHAIRMAN FONDA: I think one of the important points in this whole argument is, as I have said before, the personnel, the type of people that you are talking to. Probably, if you went after your organization, you would get 95 or 98 per cent of the men to join, if you sat down and talked the thing over with them.

We couldn't do that in our case. We might talk to some of the newly employed men for a couple of days, and they wouldn't know what we were talking about. We therefore organize English schools and try to teach them some of these things.

MR. E. L. MILLIKAN (Blackstone Valley Gas and Electric Company, Woonsocket, R. I.): If the men in these benefit associations are only those who expect to get something out of it, you will soon go broke. Your salaried employee is in the class of those who are contributing to the general welfare. Now, if they stay out, in the first place, as Mr. Fisher says, it shows a lack of co-operation with the management; and then, aside from that, no matter what salary a man is getting, if he can get a little cheap insurance, it will pay his doctor's bills anyway, and he will need the rest of his money for use on other things. I think the salaried man ought to be in it as well as anyone else.

NEW PLAN FOR COVERING SALARIED MEN

MR. H. W. FORSTER (Independence Bureau, Philadelphia): I recently sat in a series of conferences with about 2,000 public utility men and women, where the proposition was about fifty-fifty on salary and hourly. The solution that was worked out and approved by the management and the industrial plants was this: the management states that it has put into the sick and accident pay envelopes of disabled salaried employees a certain number of dollars per year—let us say $15,000 a year—to give something to the salaried people and nothing to the hourly people. The management says, that we will give you $20,000 more than you have paid in the past and you go and use that $20,000 among the bunch of you on a co-operative basis.

As a result of that they work out with apparent satisfaction to the hourly men and to the salaried people, a plan as follows: First of all, voluntary membership. Secondly, everybody came in and paid dues according to their earnings. The company paid an amount equal to those dues dollar for dollar, and that meant that the laboring man got for the first time some of the money from the company. Thirdly, the company agreed to pay to the salaried men certain additional percentages of their pay, the amounts ranging from 10 per cent with one year's satisfactory service, up to 50 per cent with five years or more of service.

In this way the company was putting a little more emphasis on long service. But the spirit that has got to rule in an association of that kind is one of working together to protect ourselves. Now, let us not,

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those of us who have had some benefit, be selfish and hold out what we have, and keep away from those fellows who earn less. They need it more than anyone else.

MR. MACLACHLAN: The salaried man usually has insurance. He has other ways, also, in which he invests his money. He feels sometimes that he can't take on any more and carry it. And you have got to show him some benefit. That is one of the difficulties that we find in dealing with the salaried employees.

CHAIRMAN FONDA: In our plant at Sparrows Point, we found that there were five distinct organizations among the employees—iron workers, foundry men, railroad men, steel men and yard men. We came along with this proposition, and told them about it. They had been asking the company to collect their dues for them, which the company had been doing. That was one of their bugaboos—to get the men to pay up; whereas in most of the industrial plants, the dues come through and are deducted automatically. The men like it after it starts and everything moves along smoothly. We told them that we could not continue making deductions for these individual associations. We had no idea of having them dismissed, but they could suit themselves, and if they chose could go ahead and continue the associations and have their own treasurer collect the dues. In this new association the cost was to be 40 cents a month, and this would be deducted from their pay.

Our general experience was that in all of those associations, with membership in some cases of 900 to 1,000 men, they took on this new association because of the fact that the rate was low, even in the face of other rates they were paying for additional insurance.

Now, that is the same thing, although on not quite so large a scale as with your salaried employee, perhaps, who is buying a larger amount of insurance. Today those associations are gradually dying out because of the difficulties in collecting dues from the members; men will be suspended from membership, and it is only the older men who are remaining. Of course, as those men are off the job more frequently and are apt to die sooner or later, the organization will eventually break up; that will be the ultimate end of the thing if you are not so fixed that you can guarantee a large membership and a regular collection of the dues.

MR. WOEDTKE: Mr. Forster made a statement a minute ago with regard to salaried employees receiving payment from the employer when sick over and above the amount of the benefit from the association, ranging from 10 per cent up to 50 per cent, according to length of service.

Now, that is a new one on me. I have had that problem in my mind for a long time, wondering how it could be solved. And I would like to ask if there is anybody else here who has in their association, or their firm, a definite scale based on length of service for salaried employees that would be paid from their wages when sick over and above what they get from the benefits of their association.

CHAIRMAN FONDA: I know that the New Jersey Zinc Company has a plan something like that, but there is no one here that represents them. However, Mr. Rice may be able to answer that question.

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MR. E. A. RICE (Federal Mutual Liability Insurance Company, Boston): In the plants where we have these plans in force for the salaried employees, the only differentiation I know of is where the company has contributed to the wage employees and has not contributed to the salaried employees.

But, opening the whole scheme of insurance classification, that plan reacted in this way: It created a sort of a line between those employees and some of the lower paid salary employees that felt that they were discriminated against.

Personally, I think the way to handle the thing is to do it on a democratic principle and have all the employees coming into the association come in on the same basis. It is a known fact that four-fifths of the association insurance sold in this country is sold to men whose salaries are comparatively small. And I think one of the best ways to form your association is to put it up to all your men to come in on an even basis. In that way you don't establish classes among the people doing different kinds of work. I think if you have a length of service plan, that it would be a good plan to make it uniform throughout.

CHAIRMAN FONDA: Regardless of what the man may earn?

MR. RICE: Well, up to a certain percentage of his wage.

COMPANY CONTRIBUTES TO BENEFIT ASSOCIATIONS

CHAIRMAN FONDA: Let us pass on to our next subject, "Desirability of part contribution by employer in supporting finances of relief and beneficial associations"—and, in the same connection, the extending of the company facilities to help develop the association. I mean by that deducting dues and perhaps allowing certain employees sufficient time to carry out their duties in connection with the association.

Take it for granted that all these associations are run practically by men elected from the rank and file, and, of course, it requires time on their part to put over the work. In our case we contribute just arbitrarily, taking a figure which will be approximately a fifty-fifty proposition. At the present time when a man pays 40 cents dues, the company puts in 80 per cent, or 32 cents. That means that every time a due deduction is made per month, it gives us 72 cents in the treasury per man.

The by-laws are not written so that the company is compelled to pay any amount whatsoever; that is an arbitrary figure. By making a study of the expenses and determining what a certain amount of money would accomplish, we can arrive at a figure.

Extending our plans for benefits is also a thing that we have been thinking about. In case the dues were raised to 50, 60, or 75 cents per month, the company would probably determine to match it. That is our position in the matter. We would also make deductions of dues through the time department and allow the elected officers of the association the time they need in making payments of sick benefits. These are made at the home office in each case where the representatives of the families come and get their money.

MR. F. E. CHAPMAN (International Harvester Company, Chicago):

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Our employees benefit association has a contract with the company, whereby the company, in consideration of 75 per cent of the shop employees being members through the year, will donate, for the purpose of defraying expenses of administration of the superintendent's office, $50,000. If the membership falls below 75 per cent and is in excess of 50 per cent, the company will donate $25,000. A section of our by-laws provides that the company contributions shall be used solely for that kind of expense.

The company donates the services of administrative officers and furnishes free office space for the benefit association.

A few years ago it was deemed advisable to make a rough estimate, if possible, as to just what that represented in dollars and cents. A survey was made by the accounting department, and at that time (I think it was in 1917), it was estimated that the company had donated about $38,000 worth of services. So the outlay for the company for the year was computed at $88,000.

SANITARIUM CARE FOR TUBERCULOUS EMPLOYEES

The company goes further than that. In the treatment of certain classes of disease, for instance, tuberculosis, we have a practice in the benefit association which is not covered in the by-laws. When a man becomes disabled from tuberculosis and has dependents, so that the sick benefits are required for the support of wife and children, or parents if necessary, or brother, or a crippled sister, or something of that kind, the benefit association assumes the sanitarium expense, which in these days costs about $90 a month in any standard sanitarium. If the disabled member has been in the employ of the Harvester Company for eighteen months or longer, the Harvester Company says, "Mr. Benefit Association, we will join you fifty-fifty on that sanitarium expense." That is quite an item in a big organization like ours.

Owing to business conditions at the present time our membership is a little under 17,000. The percentage runs well over 90. The reason for so high a percentage, even though there is a reduced number of employees, is that when the benefit association was started in September, 1908, the bars were down—any man who was then on the payroll could join the benefit association without any physical examination and without age limit. I took them in as high as 78 years of age with locomotor ataxia and every other chronic ailment that there was, and we have been paying for them ever since. You might say some died the next week after they came in. That was an extreme hazard. We expected it, but the applications for membership in the first nine days averaged 1,000 a day.

A few minutes ago I was interested in the topic on what to do with the salaried man. The Harvester Company has no cut and dried plan for payment of salary to a member of the association while he is disabled. The amount of the salary which the disabled man will receive, whether it is full salary or a portion, is left entirely to his superior. It is conditional upon his value to the company as an employee, his dependencies, and his length of service.

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On the question of membership, whether it should be compulsory or not, when we started out in the early part of 1909 to have membership in our association on a compulsory basis. We dropped that idea, and we are glad that we did.

ASSOCIATION BY-LAWS PRINTED IN FOREIGN LANGUAGES

The foreign language speaking man in the foundry who can't understand a thing in English was given a copy of the by-laws of the association printed in his own language, if we happened to have it. We made an analysis, found out what languages were spoken by the ten largest numerical groups, and printed it in those languages. Since 1910, through education or one thing or another, we have been able to cut out three of those languages.

We pay a sick benefit of one-half of the average daily wage based on the earnings for the last 60 days, with a maximum of $1,000 for the year. Nobody can contribute on a salary or wage earning basis of more than $2,000. He draws benefits in proportion to his contribution.

MR. LEY: Have you any figures to show what it costs?

MR. CHAPMAN: That would be 58 cents a week.

MR. FORSTER: I wanted to have Mr. Chapman bring out this fact. The Harvester Company is one of the few associations which are old and large and successful and in which the employees carry virtually all of the expense. Because the Harvester Company contributed $88,000 in 1917. I should estimate that the employees contributed $600,000 to $800 000. It isn't a fifty-fifty proposition; it is on the basis of the employees paying the freight.

MR. CHAPMAN: Paying the freight so far as the benefits were derived.

MR. FORSTER: What was your annual income in 1920?

MR. CHAPMAN: Our annual report for the year ending December 1, 1920: Revenue contributions by members, $747,000. Interest on cash balance, $10,000. (By the way, that represents four per cent on our average cash balance left with the treasurer of the Harvester Company.) Interest on investments, $26,000. Total revenue, $784,000.

MR. FORSTER: Now the company spent $88,000, which is one-tenth of the total amount. We want the men here to get that point, because people have benefit associations where they pay virtually all of the money.

MR. LEY: How much surplus have you?

MR. CHAPMAN: We have a pretty good surplus notwithstanding the fact that we went through two epidemics. Our surplus at the end of the year, our balance available for disability and all fluctuations, was $622,000.

MR. LEY: You accumulated that in about 10 years?

MR. CHAPMAN: No, 12 years. If there is no improvement in conditions, we are going to get into a hole this year. There has been a good deal of sickness, and that is one reason why I expect a loss this year. It is not going to be a material amount, we are not going to be crippled in any way, but our disbursements are going to exceed our revenue.

The reason for that is this: We are carrying at the present time a large number of so-called chronic cases. We are paying benefits on an old

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ratio of contributions and earnings, and our present contributions are being received on the basis of reduced earnings.

CHAIRMAN FONDA: But it isn't due to worse health conditions; it is due to our present industrial situation.

MR. CHAPMAN: Partially, but health conditions are a factor.

MR. WOEDTKE: Wouldn't you expect, with the experience you have had, that by this time you could determine an average health condition that ought to enter into your budget? You must have that by this time.

MR. CHAPMAN: We have just furnished the United States government with some information, but an analysis has not yet been made for the year 1920.

MR. WOEDTKE: I presume that you have a pretty definite health standard, and that you have expenses which are necessary to allow for that.

MR. CHAPMAN: A line on that is obtained in the comparison we published in our annual report. We show the figures for 1916 to 1920, inclusive. The average length of sickness disability per case in days follows: 1920, 18.9; 1919, 20.5; 1918, 20.7; 1917, 20.6; 1916, 20.5.

In 1920 the number of lost time cases was less, but our average amount of time for members was increased. In 1916 our average amount of sickness benefit paid was $37.26 per case, and in 1920 it was $50.16. That is due to increased earnings, because we pay on the basis of the man's earnings and his contributions; the higher wages he obtains the more benefits he gets.

COMPARISON OF STATISTICS ON FREQUENCY AND SEVERITY OF SICK AND DEATH CASES AS COVERED BY RELIEF ASSOCIATIONS

CHAIRMAN FONDA: Let us go on to the third topic: "Comparison of statistics on frequency and severity of sick and death cases as covered by relief associations."

I have brought comparative figures for the first eight months of this year, showing the relationship between frequency of lost time accidents and frequency of sickness cases, and also some figures as to the cost of sickness to the man and the cost to the company.

For instance in our accident experience—take our death cases—our fatality rate has been .56 as against 4.34 sickness per 1,000 men. A death case out of the course of employment is covered by the relief association. For instance, if a man has left a plant and is killed by a trolley car or an automobile on the streets, that is a relief case. In our fatality figure on relief is included such accidental deaths. I haven't that figure here with me now, but there are very few of those. We have about 60,000 employees. I might say at this time that we don't pay relief in addition to compensation.

MR. C. F. GLUECK (John Hancock Mutual Life Insurance Company, Boston): Does that cover all branches of the steel industry?

CHAIRMAN FONDA: Yes.

MR. GLUECK: What year does that cover?

CHAIRMAN FONDA: That was this year—first eight months of 1921. To get a yearly basis, if you continue on that experience, divide by 8 and multiply by 12.

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MR. WOEDTKE: What inference do you draw from that?

CHAIRMAN FONDA: I think that Mr. Rice and some of the other insurance experts will tell you that the normal death rate of sickness cases is about six to seven per thousand.

MR. RICE: I think so. Sickness cases differ with each individual plant. We were surprised to see that in a plant where we thought the hazard would be the greatest, the actual amount of claims was the least.

This leads me to believe that a uniform basis of rates for industries that are alike cannot be adopted. But you have got to take every individual plant. We found that the loss ratio in tanneries in two representative cases was much less than machine plants; we found the loss ratio in steel plants to be less than in light machine plants.

It leads me to believe that the man who works in the steel mill is a tough man in physique, and the same is true of tanneries. So it seems to be that you cannot adopt a uniform experience by figuring on the plants that are alike.

In a great many plants we have paid about one out of eight people money from year to year. This last year shows a low experience on health. The whole thing is a matter of science, and I think the insurance people figure that we are now on the bottom of the curve and we are gradually going to come up and then go down again.

MR. WOEDTKE: What would the average of all those industries be?

MR. RICE: I would say roughly about one case out of every eight people employed, cutting out the first week, however. The usual form has been to cut out that first week. That would of course affect the payments.

CHAIRMAN FONDA: There is another figure that I would like to give you on these comparative statistics; for instance the number of days lost (severity rate) on sickness as against accidents. Normally our average for days lost per hundred men per month runs about 12 days in steel mills as against about 42 for sickness. Approximately twelve days per hundred men a month is the severity rate on accidents as against 42 days loss per hundred men a month in case of sickness.

MR. FORSTER: What do you know of accidental deaths outside of a plant and accidental time loss outside of a plant?

CHAIRMAN FONDA: That is a very small item in our plant.

MR. CHAPMAN: Accident disability cases off duty, total number of accidental cases reported among the members of our association during 1920 was 618, of which 610 drew accident disability benefits. In the other 8 cases deaths were immediate.

Number of cases reported in 1919, but carried into 1920, was 12. Of the total number of 630 cases of accidents, 8 died and 18 were still disabled on December 31, 1920. The average of disability due to accident was twelve and nine-tenths days and the average claim was $38.55. Total time paid on account of accidents was 8,010 days.

MR. FORSTER: What percentage of your total payments went for off duty accidents?

MR. CHAPMAN: That hasn't been computed. The association of the Harvester Company pays benefits from the time of the accident.

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CHAIRMAN FONDA: Do you pay benefits in spite of any compensation that the employee receives?

MR. CHAPMAN: We don't pay when the compensation law is involved. The company pays for shop accidents; the relief association pays for the non-shop accidents.

CHAIRMAN FONDA: In answering the question as to what is our conclusion on our statistics, my principle interest is to get some comparison within our plant to satisfy ourselves that our accident experience is as good as we can make it.

I figure that with ordinary fatalities due to sickness running about eight times that of deaths due to accidents in the steel and ship building industries, the record of fatalities is fair. I know that before we were organized on safety work, the fatality rates were up to two and three per thousand instead of .56 per thousand.

MR. WOEDTKE: Don't you think that the fact your accident fatality rates are much lower than the average is due directly to the intensive accident prevention work that you do?

CHAIRMAN FONDA: I certainly think it is. If that weren't so, we would be doing ourselves out of a job.

SHOULD REDUCE SICKNESS AS WELL AS CREDIT RATES

MR. WOEDTKE: If that is true, don't you think it is high time that the safety men who are tied up with this sort of thing made a more intensive study and more intensive effort to reduce the sickness rates, if it is possible to do so?

CHAIRMAN FONDA: Right. It is a much more difficult thing to do, however.

It isn't easy to organize within yourselves to prevent sickness and reduce severity and frequency of sickness cases. Just as Lew Palmer says here, you get into home and neighborhood conditions.

MR. WOEDTKE: The thing in my mind is to put this apparently steady growth of the so-called mutual benefit associations, which is becoming more and more in vogue and is taking the place of the labor man's pension and all that, into a separate group of the National Safety Council.

CHAIRMAN FONDA: Mr. Douglas just made a remark to me as a result of this meeting here today, that we ought to form a group within the National Safety Council and get together annually or semi-annually. I think it is a very important question.

After some discussion, a motion was passed instructing the chairman to appoint a committee to consult the officers of the National Safety Council with a view toward forming an Employees' Benefit Association section in the Council and to prepare a suitable program for the meetings to be held at the 1922 Congress. The following were appointed as members of this committee:

Chairman, F. E. Chapman, International Harvester Company, Chicago.
L. D. Woedtke, Fred T. Ley & Company, Inc., Springfield, Mass.
J. B. Douglas, United Gas Improvement Company, Philadelphia.

MR. CHAPMAN: Just what was intended to be covered by the topic, "Desirability of limiting extent to which benefits may be obtainable?"

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CHAIRMAN FONDA: One of the points brought up here was what your company and my own company have determined in the same way—not to pay benefits from the relief association in cases where men are receiving compensation from accidents. That is to avoid reaching a point where a man has a source of revenue that gives him more money off the job than on.

The question of judgment is the thought I had in mind here. Which is most desirable: to pay benefits when compensation is received in addition, or not to pay in such an event?

MR. FORSTER: I think I can say from some knowledge of the subject that it is unusual to pay compensation if benefits are being paid. If they are paid, it is because it is to make up the difference between the compensation scale and half wages, or whatever classification plan there may be, so that a man who is hurt outside or inside a plant gets a certain amount of money.

I think a man should get half pay whether he is hurt on the street or in the plant. Another way of doing that, which is unusual but feasible, is to pay the man a flat sum like $5.00 a week on top of compensation.

Those are two ways which seem to work very well. In a few cases, like the Curtis Publishing Company, they pay compensation regularly through the association on top of the state benefits. But they have so few accidents in a modern printing plant, that it doesn't amount to a hill of beans. They have doctors who take care of everything.

CHAIRMAN FONDA: If there are no other points to be brought up, we will adjourn.

ADJOURNMENT.

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Engineering Section

September 27, 1921

L. A. De BLOIS, Chairman
Manager, Safety Section, E. I. du Pont de Nemours and Company, Wilmington, Del.

B. F. TILLSON, Vice-Chairman
Assistant Superintendent, New Jersey Zinc Company, Franklin, N. J.

S. J. WILLIAMS, Secretary
Secretary, National Safety Council, Chicago

TUESDAY AFTERNOON SESSION

THE first session of the Engineering Section convened at 3:00 P. M. in the Massachusetts Institute of Technology, after an inspection trip through the Institute. Mr. Tillson presided and read a letter from Mr. De Blois, who was absent; adding the suggestion that the section hold joint meetings with other engineering societies during the year.

Mr. Fred M. Rosseland of the National Safety Council reported that the membership of the section had increased 20 per cent during the last year. Two meetings were held, in Philadelphia on February 28, and in Cleveland on May 31. Each of these meetings was held jointly with the local engineering society.

The Engineering Section has taken an active part in the work of the American Engineering Standards Committee and its several sub-committees. The Council is the sponsor for four different codes (paper and pulp, power presses, construction, and textile) and is joint sponsor with the American Society of Mechanical Engineers in the proposed code for a standard color scheme for pipe lines. The Engineering Section is represented on sixteen code committees.

CHAIRMAN TILLSON: The first paper will be presented by Mr. Banash.

LESSONS LEARNED FROM OXY-ACETYLENE AND OTHER GAS WELDING AND CUTTING PROCESSES

J. I. BANASH, CONSULTING ENGINEER, CHICAGO

Could we but be assured that those who are directly concerned with the operation of the various forms of apparatus used in connection with

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gas welding and cutting, would without exception read and heed the instructions and advice contained in the Council's admirable treatise relating to Safe Practices in Welding, very little else in the way of safeguards could be desired. But such a millenium is remote, if not unattainable; and under the circumstances one may well find comfort in the reflection that, with reference to the development of knowledge concerning its applications and processes, the oxy-acetylene industry is today much freer from hazards than many others with which we have become so familiar that their elements of danger are sources of scarcely any public alarm at all.

Were one to cast up an acurate calculation showing the ratio of accidents to the entire volume of equipment or of the personnel employed in the oxy-acetylene industry and then prepare a similar reckoning with respect to mining, lumbering, general manufacture or even agriculture, there can be little doubt that the hazards connected with gas welding and cutting, if not insignificant in comparison, would at least appear relatively low.

I have thus introduced at some length the hazards, or rather non-hazards, connected with gas welding and cutting because the title of this paper would seem to suggest that the safety of these processes has not been developed to an extent where the apparatus employed and the applications involved are to a very great extent free from accident. In point of truth, it is to the lessons that have been learned and to the application of the knowledge thus gained that the industry owes the fact that it is on a basis of substantial safety today.

Yet, notwithstanding this fact, there is no commercial product that is more frequently misrepresented in the news columns of daily papers than acetylene. The average reporter seems to have a special weakness for the word, as if it were a general term applicable to, even essential to, a proper denomination of all mysterious, or not definitely accounted for explosions. Every little while one reads of acetylene explosions or of the explosion of acetylene torches, and when the reported cases are authoritatively investigated, as they generally are, it is discovered in nearly every instance that the explosion was not an acetylene or an acetylene torch explosion at all.

During one recent week the newspapers in New York City reported four accidents as being caused by acetylene. Each was thoroughly investigated and its origin determined definitely to be distinctly otherwise than had been reported. In all of the cases it was found that acetylene had no connection whatever with the accidents. (Mr. Banash then described these accidents in detail.)

It is doubtful if any industry involving moving parts can be carried on year in and year out with so few accidents as occur in this line. The reasons are obvious. So much special attention has been called to the hazards of acetylene, and so much careful and exhaustive study has been given to the subject, that its main hazards are recognized and proper protection against them is afforded. Of course accidents do occur now and then, but it may be emphasized that generally they are caused through ignorance or through gross carelessness.

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One does not read much of the danger of air and water as explosives. Just simple everyday aqua pura, the kind that comes from the well or a bathroom faucet, is dangerous under certain conditions and so is air dangerous under the same conditions. Unfortunately those conditions obtain under circumstances in which they are not always apparent, the conditions being confinement and application of heat in a sufficient degree for expansion to burst the confining walls. It is not difficult to understand how this knowledge might be very useful to the oxy-acetylene operator. An example of an explosion of this kind, in which acetylene might have been, but was not used, occurred about a year ago in a New York welding shop. Incidentally because oxy-acetylene apparatus was a part of the plant equipment, the newspapers deduced another "acetylene explosion". The facts were these: an automobile tubular drive shaft was placed in the fire of an ordinary blacksmith's forge for heating, preparatory to straightening the tube. Unknown to the workmen, the tube contained confined air. Had there been so much as a pinhole the expanding air might have escaped without violence. It would have been a very simple matter to tap the tube with a drill. This precaution was not taken merely because the air inclusion was not obvious. The result was an accident that sent several workmen to the hospital. Similarly, also about a year ago, a workman engaged in welding a hollow metal ball did not know that the ball was filled with water. Why it was so filled is a mystery. But the water expanded under the heat of the welder's flame, the ball breaking like a bomb Fortunately the workman was not killed, and was thus permitted to learn by experience what all the rules of caution ever put into print could not teach him so thoroughly. This also was served up to newspaper readers as an oxy-acetylene explosion. Of course it was nothing of the kind, but by the time the facts were ascertained the story had ceased to be news.

Early last winter in a scrap yard in upper New York State, an oxy-acetylene cutting blowpipe was used in cutting a piece of angle iron into short lengths. One end of the angle rested on a steel drum. When cutting directly over the container, the flame penetrated the steel shell, causing the end to blow out, seriously injuring the operator.

These accidents teach us that more care should be observed not only in ascertaining the character of the work to be undertaken, but to avoid cutting into tanks and steel containers without knowing for what purpose they have been previously used.

ABUSE OF CONTAINERS MAY CAUSE ACCIDENTS

The subject of shipping containers also reminds us of the misuse to which oxygen and acetylene cylinders are sometimes subjected. Gas manufacturers have found deep nicks and dents in cylinders which have been returned to them for refilling, indicating that the cylinders were used as a base upon which to work with a chisel. Cylinders are sometimes found flattened, indicating that they have been used as rolls for moving heavy material. While, to our knowledge, no accidents have resulted from such treatment of compressed gas cylinders, nevertheless

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these conditions should be corrected. Such treatment of cylinders not only destroys the gas manufacturers' property and necessitates his casting aside the cylinders as scrap, but it endangers the lives of workmen who resort to such practices and the men employed in the gas re-charging station, if the damaged condition of the cylinder should not happen to be observed before re-charging.

The quality and size of hose are important factors in the safe operation of equipment and should be more carefully observed. Last spring in a large steel mill in Ohio, a salamander was being removed from a blast furnace. Several cylinders of oxygen were coupled to a suitable manifold. The hose between the oxygen regulator and the steel pipe used in burning the holes in the salamander, was of extra large diameter and reinforced with heavy wire wrapped about the outside. The end of the steel pipe became plugged and as the regulator happened not to be functioning properly, the full pressure in the oxygen cylinders was allowed to build up in the hose itself. Not only the hose burst but the wire reinforcement on the outside of the hose was shattered into small pieces, the flying particles cutting a number of the workmen. Fortunately, none was severely injured. The indiscriminate use of any piece of hose should be eliminated.

Care should also be taken to determine the proper diameter of hose for acetylene, especially when extra long lengths are required. Sometimes hose of a very small diameter is used with the result that, in order to obtain sufficient acetylene pressure at the blowpipe, the reducing regulator at the acetylene cylinder is required to deliver acetylene into the hose at a pressure exceeding 15 lbs. per square inch. It is a well-known fact that free acetylene should never be subjected to a pressure in excess of 15 lbs. per square inch.

A 150-foot length of hose, ¼ inch in diameter, theoretically requires a differential of about 5 lbs. in pressure to overcome the loss of pressure due to friction between the acetylene regulator and the blowpipe itself. Allowing for kinks and turns in the hose, in actual practice this differential should be approximately doubled. In this event, the operator may be obliged to carry over 15 lbs. pressure in the acetylene hose.

A 150-foot length of hose, ⅜ inch in diameter, theoretically requires a differential of only about 0.7 lb. to overcome the loss of pressure under similar circumstances; or in other words a differential of approximately 1.4 lbs. under actual working conditions. Thus, it will be readily observed that a slight increase in the diameter of hose, when extra long lengths are used, overcomes this difficulty.

While no serious accidents can be attributed to this cause, nevertheless the possibilities of such accidents, when long lengths of hose are used, should be recognized, and hazardous conditions avoided by the use of proper size hose.

PROPER VENTILATION A NECESSARY PRECAUTION IN WELDING OPERATIONS

Ventilation is another precaution that should receive more careful attention. Quite often in ship construction or ship repairs, operators

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are required to weld or cut out in very confined spaces. Frequently a large welding flame is used to heat up a given area for driving out a buckle or for fitting up a plate or angle properly for riveting. It should be borne in mind that the air in the lower portions of a ship's hall is generally foul during the process of construction, as well as after a ship is in commission. The use of any kind of a flame, from either a blowpipe or a forge, is bound to consume some of the oxygen in the small compartments in which the operators are obliged to work, and this will affect their breathing unless adequate ventilation is provided. Blowpipes, either welding or cutting, may be applied in these confined spaces to surfaces covered with paint or red lead, giving off lead fumes which are known to be injurious. One or two shipyards have had minor difficulties of this nature in the past year or so, and these emphasize the fact that provision for adequate ventilation should not be overlooked.

Another place in which sufficient care is not always exercised is in the protection of workmen on construction work, who chance to be below operators engaging in cutting. Not only should provision be made to protect the men from the sparks, but care should also be taken to see that no inflammable material is left where it might be ignited. And, while referring to cutting, it may be well to emphasize the importance of always wearing goggles when in range of sparks or when doing continuous or heavy welding. A good practice is to wear goggles whenever the torch is in actual use.

Every now and then we learn of an accident with an acetylene generator where the operator tampered with the safety valve or did not realize the danger of generating acetylene under a pressure in excess of 15 lbs. While these instances are becoming less frequent each year, the warning against such risks should still be preached.

Opposed to the instances in which accidents of a serious nature occur in the careless operation of generators, or in the instances due to faulty construction of generators built contrary to established rules, are other instances in which standard generators of approved types have been accidentally subjected to and have withstood extraordinary fire tests. The following case is fairly typical:

A little more than a year ago at a fire in Houston, Texas, a 50-lb. pressure type generator emerged entirely free from any damage that could be directly or indirectly charged to acetylene. Everything but the generator was a complete loss. The generator was fully charged at the time of the fire, had been in use just previously, and when reached by the flames was carrying a full head of gas. The intense heat melted all of the brass parts, destroyed all of the piping and weakened the spring in the pop valve, after which the vent remained open, the gas igniting and flowing out in a flame several feet in length. The water seal, however, effectually prevented the fire from flashing back into the generator chamber. It is worthy of note that the generator was readily restored to service and that it was the only considerable item of equipment that could be salvaged.

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HAZARDS DUE TO MISAPPLICATION—NOT TO CORRECT USE

The more one delves into the history of the gas welding and cutting industry, the more one is impressed with the fact that the actual hazards are in the misapplication of the process rather than in its correct uses. And it is an encouraging reflection that the industry itself, through its leading manufacturers and the International Acetylene Association, is constantly endeavoring to eliminate those misapplications that are detrimental to bodily safety. It would be indeed ungrateful, however, were we of the industry to begrudge a cordial acknowledgment of the invaluable contributions of such helpful and wholesome organizations as the National Safety Council, Underwriters' Laboratories and the National Fire Protection Association, in educating the public regarding the proper safeguards and precautions to observe in the manufacture, transportation and use of the supplies and equipment that pertain to the industry.

With reference to the safety of apparatus and cylinders, insofar as concerns specifications for manufacture and handling up to the time they are in the hands of users, it is my opinion that these matters may well be left in the hands of the manufacturers, who are guided therein by the International Acetylene Association, Underwriters' Laboratories, Inc., the National Fire Protection Association, the Bureau of Explosives, and the Interstate Commerce Commission, each of which, within its province has laid down definite and well-considered rules and specifications governing the construction of such equipment. The work of the National Safety Council, I believe, may better be directed particularly to aiding in correcting misuses of the apparatus and misapplications of the process, as already noted. It is along this line that, seemingly, the greatest ultimate good for the industry as a whole can be achieved, and I am glad to be able to say with every confidence in the issue that I believe your worthy Council is destined to add immeasurably to the debt of gratitude our industry already owes, by materially assisting in placing oxy-acetylene welding and cutting on as nearly a 100 per cent basis of safety as it is humanly possible to attain.

DISCUSSION

MR. E. S. CHAPIN (Pennsylvania Railroad): We have extended the use of the oxy-acetylene process within the past few years. Formerly we had severe injuries due to rivets flying, and naturally, if we cut these off with a torch, they do not fly.

MR. J. E. LONG (General Electric Company): Which is the safer to use, electrolytic oxygen or a liquid air process?

MR. BANASH: Underwriters' Laboratories have a standard and any form of oxygen can be made with the proper measure of safety, if attention is paid to it.

MR. E. A. HOENER (Firestone Rubber Company, Akron, Ohio): We recently had an accident at our works, which might be interesting to the industry. We had an empty drum (supposedly empty), for an oil container, and a man was asked to burn the head of it out. It seems that this drum had been used a long time ago for keeping rubber cement,

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and a small quantity of it was left in the drum. The man rolled the drum around to make sure it was empty, and as far as he knew it was. He endeavored to get the plug open. He couldn't get it open and took a chance. The result was that the drum blew up and killed him. We have since issued instructions that all drums are to be opened and filled with water, and thoroughly drained again, to make sure no repetition of this sort of accident occurs.

CHAIRMAN TILLSON: Tanks used for gasoline, though open and empty, are a poor thing to operate on with an acetylene burner. There is some vapor left there and sometimes it flashes.

MR. BANASH: The proper remedy is to fill your container with water.

MR. R. S. BONSIB (Standard Oil Company, New Jersey): It is very important to be sure the thing is filled to overflowing. We had a little experience (I won't say accident), in the repairing of one of our tank wagons. The wagon had been filled to overflowing (presumably); then the man wanted to be sure there was nothing left, so he took a little piece of paper, lighted it, and threw it into the tank. Nothing happened except a little flash; but often in filling tanks, if you do not fill them to overflowing, a little pocket is left; when you fill with water, the gas will be compressed, and when emptied, will re-expand, and you will have a wonderful mixture.

MR. BROADWELL (Republic Tire and Rubber Company): A fire ocurred two or three years ago, in an industry in which more or less dust is created, which accumulated on the steel work on the upper parts of the building. We attempted to do some repair work with an acetylene torch, and the flame ignited some of this dust, which ignited other dust, smouldered for several hours, and finally set the plant on fire. It was not the fault of the oxy-acetylene, but the fault of the operator, who should be cautioned to clean away the dust.

PROF. R. MCA. KEOWN: Several cylinders in a plant in Wisconsin blew up on account of being left out in the sun, in an enclosed alley-way, where there was not much ventilation. As I understand it the cylinders are charged with about 250 lbs. at 70 degrees temperature, and there is a rise of about 25 lbs. of pressure for every degree rise of temperature.

MR. BANASH: A properly made cylinder would hardly explode under those conditions. Probably if we traced it down, we would find that those cylinders came from a plant, of which there are several, who do not put out cylinders in conformity with the Interstate Commerce Commission's specifications.

MR. R. A. BLOOMSBURG (Utilities Mutual Insurance Company, New York City): Several months ago we had an accident in a confined space, six or seven feet in diameter, where two or three men were working with torches and were overcome, although no serious injury resulted. They were unconscious for ten or fifteen minutes. The doctor's diagnosis seemed to show some indication of carbon monoxide poisoning. I was wondering whether this was normal or whether there was an abnormal adjustment of the torch.

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MR. BANASH: Except in a very confined space where the air is bad, I wouldn't expect carbon monoxide. These cases are very rare.

CHAIRMAN TILLSON: We have as the next speaker on the program, Dr. Warren K. Lewis of the Massachusetts Institute of Technology, who has been our host today.

SAFETY IN THE EVAPORATION OF VOLATILE SOLVENTS

DR. WARREN K. LEWIS, MASSACHUSETTS INSTITUTE OF TECHNOLOGY, CAMBRIDGE, MASS.

Volatile solvents are widely used in the impregnation and coating of fabrics as, for example, in the application of rubber cements to tire fabrics and rubber sheeting, in the manufacture of cellulose nitrate and acetate "dopes" for artificial leather and airplane wings, in waterproofing processes involving impregnation with bituminous and other compounds, and in many similar cases. They are also used in lacquers, varnishes and enamels. They are employed in the production of plastics, such as celluloid, artificial silks, rubber dipped goods, and smokeless powders. They are used in dry cleaning and grease extraction processes. In all of these cases the solvent must be evaporated and it is proposed to point out the dangers inherent in this evaporation and the best methods so far developed for eliminating them.

The important solvents are gasoline, kerosene, benzene, toluene, methyl, ethyl, amyl, butyl and isopropyl alcohols, ether, acetone, various esters, carbon bisulfide, carbon tetrachloride, and various chlorinated hydrocarbons. All of these except those rich in chlorine are highly flammable and some of them are toxic. Carbon tetrachloride and all the highly chlorinated hydrocarbons are absolutely nonflammable but are expensive and are subject to slow hydrolysis in contact with water, resulting in acidity and corrosion. Each solvent has its particular limits of flammability when its vapor is mixed with air; see the following table:

TABLE I: LIMITS OF FLAMMABILITY PECULIAR TO EACH SOLVENT
(Percent by volume)

Vapor	Lower Limit	Upper Limit
Ether	1.6	7.5
Alcohol	3.7	13.6
Benzene	1.4	6.3
Pentane	1.3	4.8
Motor gasoline	0.7	———

Ignition may be due to static discharge caused by friction, to defective wiring, to the breaking of electrical circuits, to sparking on motor commutators and various other electrical causes, to carelessness on the part of operators in the use of matches, to impact sparks and the like. When solvents are used out of doors, as in varnishes and the like, dilution is usually so great that explosions never occur and fires are rare and usually localized. Indoors, however, explosions are not infrequent and fires represent a serious industrial hazard.

The vapors of these solvents are toxic if inhaled in large amounts. Most of them produce dizziness and unconsciousness but fortunately only

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a few of them, notably benzene and methyl alcohol, have serious toxic effects when inhaled in small quantities. All of them however when inhaled in noticeable quantity interfere sufficiently with health to result in minor discomfort, reduced effort, poor workmanship, and high labor turnover.

The solution of the problem has been attempted along two lines, dilution with a large amount of air and evaporation in an enclosed space.

DILUTION

It has already been pointed out that where evaporation takes place out of doors natural dilution is satisfactory. Indoors however the disadvantages of this method are serious. In the first place it is difficult to ventilate a room in such a way as to eliminate air pockets entirely. In such air pockets, vapor concentrations can rise to the explosive point and serious results may follow despite the fact that the room as a whole is properly ventilated. In the second place an extremely large amount of ventilating air is required, both to serve as a factor of safety in preventing pockets and because of the fact that the explosive limits for the cheaper and more important solvents are so low. In the case of the more toxic solvents such as benzene and methyl alcohol, still greater dilution is demanded.

This necessity for excessive ventilation results in a large waste of heat in cold weather and makes it almost impossible to recover the solvent vapors from the air.

In case dilution is employed, the ventilating system must be designed with great care to produce an even distribution of air throughout the room so that pockets will not develop, and to supply at all times an air volume sufficient to provide for the maximum instantaneous evolution of solvent vapor. This air supply must be at least three to five times that corresponding to the lower explosive limit, as otherwise under the best conditions localized concentrations of vapor may reach the danger point. The ventilation must not be natural but forced because natural ventilation, however good, is subject to weather conditions, and consequently to occasional failure. One of the worst fires with which the writer has had experience occurred because of failure of natural ventilation. The vapor escaping into the room was so slight that under no conditions had it become noticeable, yet on a still, muggy night the ventilation ceased to function to such an extent that a bad vapor fire resulted.

All of these vapors are heavier than air. Furthermore, at the point where vaporization takes place, the air is usually cooled due to the absorption of the heat of vaporization. Consequently the air-vapor mixture formed is heavier than the air of the room so that ventilation should always be downward, fresh air entering at the top of the room and being withdrawn at the bottom, thus reducing to a minimum the mixing of vapor with the air of the room as a whole.

Where vapors are evolved from a table over which an operative must work, the vapor should always be drawn, not from above through a

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cone shaped hood over the table, but from the back of the table at the side opposite the operator. The cover over the table may flare upward if necessary to give more operating space. In this way all the ventilating air flows past the operative and drags the vapor away from him backward and downward as it naturally tends to go.

The ventilating ducts leading the air away from such a room represent a grave danger, especially in the case of high boiling solvents. The vapor concentration of the air leaving the point of evaporation may be quite high and the temperature sufficient to keep the material vaporized. However, this air becomes diluted with colder air from the room, resulting in deposition of liquid solvents. These solvent droplets collect on the walls of the ventilating flues and are likely to result in serious fires and occasionally explosions. Where possible the flues should lead downward to assist in the removal of this condensed liquid. They should be provided with explosion vents and cleaning doors conveniently located. Where the amount of condensed solvent is large it may be necessary to provide traps for removal of the liquid

ENCLOSED EVAPORATION

In any event such measures diminish but do not entirely eliminate the evil. This is controlled only by having the evaporation proceed in an enclosed space. This cannot be done in all cases, e. g., in the use of rubber cement in repair work and in many cementing jobs around a rubber plant. It can, however, be done much more frequently than is realized and where practicable it is by far the best solution of the difficulty. It makes possible more accurate control of drying conditions, resulting in greater production and more uniform product. It eliminates fumes from the workroom and therefore reduces to an extremely low point the danger of toxicity. It also makes it possible to recover a large fraction of the solvent used.

However, certain disadvantages are claimed to result. These are, first, the danger of fire and explosion, the latter being more serious because of an enclosed space; second, interference with production because of inaccessibility of work to the operative; and third, decrease in drying rate and completeness of evaporation.

1. It is true that evaporation in an enclosed space in the presence of air is extremely dangerous. A number of plants have operated in this way by attempting to keep the vapor concentration at all times above the upper explosive limit. Theoretically this makes an explosion impossible but the danger of getting in the explosive range by mistake is obvious. A more satisfactory method is to evaporate under a vacuum. This, however, involves extremely heavy and expensive equipment and devices for introducing and removing the stock from the evacuated space. Furthermore it is almost impossible to control the drying operation. The worst solvent fire which the writer has investigated was caused by the removal of an incompletely dried roll of goods from such an apparatus.

The dangers due to the presence of air and the operating difficulties

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due to the use of a vacuum can both be eliminated by evaporation or drying in the presence of oxygen-free gas. Carbon dioxide, sulfur dioxide, and nitrogen have been employed in the past, but, while efficacious, have been prohibitive in cost. During the last few years flue gas has been introduced for this purpose and has been found cheap and satisfactory, and obviously eliminates the danger.

2. It is obvious that equipment of this sort interferes with production in that the operative cannot so readily get at the work as when evaporation takes place in the open air. On the other hand if the enclosing hood is made accessible by liberal provision of doors and removable top, if windows and vapor-proof lights are inserted to make inspection easy, and if proper attention is paid to the design of the rolls or other equipment used for conducting the stock through the drier, it is found in actual practice that the gain due to better control of evaporation, to freedom from occasional fires, and to increased comfort on the part of the operatives has increased production and cut down labor turnover.

3. As to drying rate, it is admitted that such a system would be expensive if, in order to get complete drying, it were necessary to maintain throughout the evaporating equipment exceedingly low percentage concentrations of vapor. It is, however, doubtful whether such conditions really exist. Usually, evaporation can be made to proceed more rapidly and under better control by the use of high vapor concentrations at the point where the stock enters the equipment. This makes it possible to dry the stock with a small amount of inert gas. In one plant it has proved possible to secure an evaporation of a gallon of gasoline by the use of the flue gas produced from the combustion of a third of a pound of coke, and yet have complete drying from thin films in from three to five minutes, a production 70 per cent greater than that previously realized in open air drying. Where air leakage into the equipment is small and where the solvent is recovered from the gas leaving the apparatus, one may recirculate a large amount of the waste gas, thereby still further decreasing the amount of gas used for the evaporating process.

It will perhaps be helpful to those interested to outline in some detail the conditions that must be met in designing the equipment for such an installation.

Most hydrocarbons will not explode when mixed with a gas which contains less than 12 per cent of oxygen. It is therefore unnecessary to have the gas absolutely oxygen free. It is good practice to keep the oxygen content at every point in the apparatus below 6 per cent. There is no difficulty whatever in operating continuously with concentrations between 3 and 4 per cent, even where there is considerable air leakage into the apparatus. Where such air leakage occurs it is obvious that enough flue gas must be employed to dilute it down below the danger point.

BEST METHOD OF GAS PRODUCTION

On a small scale the gas is best made in a special oil burner, although a gas producer may be employed. Where large quantities of gas are

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required one should employ a special boiler with a dutch oven type of grate using an unusually large grate area and with the whole boiler setting enclosed in air-tight boiler steel casing. The fuel employed should be coke, because this produces no tar and a minimum of dust. The fuel consumed per square foot of grate area should be low (not exceeding 7 lbs. per hour) because a high fuel rate tends to produce blow-holes and inequalities in the fuel bed resulting in oxygen in the flue gas and because the high gas velocity through the fuel bed necessary to give a high combustion rate carries dust and soot into the gas. The fuel bed should be deep (about two feet) to insure complete elimination of the oxygen. There should be ample combustion space above and beyond the fuel bed before the gases come in contact with the boiler in order to complete the combustion of any dust particles which may have gone into the gas. The gases must then pass through a water seal and some sort of cooling device, best a water spray, to cool them. The whole gas production equipment should be operated under pressure so that any leakage will be outward and not in. The fire should be operated at a low temperature, 800° to 1000° C., because under these conditions combustion goes mainly to CO_2 and very little CO is produced. This low operating temperature is also necessary in connection with the low combustion rate. On acount of the positive pressure special provision must be made for firing, but there are a number of mechanical stokers on the market which meet this condition.

As already stated, for small installations an oil burner or a small gas producer is better than a boiler, although the heat goes to waste. Gas producer conditions as to thickness and temperature of fuel bed, combustion rate, the necessity for positive pressure, etc., are the same as for a boiler.

Over the apparatus in which the evaporation of the solvent is to take place one must construct a hood. The shape and character of this covering obviously depend on the particular operation for which it is to be used. It is, however, important to have the free volume inside the machine as small as possible and to provide for positive counter-current flow of the gas over the stock so that fresh gas entering the apparatus, vapor free, will remove the last traces of solvent vapor from the stock while the gas leaving the apparatus will be saturated with solvent and the amount of gas required for the operation will be reduced. The apparatus should be as tight as possible although there is almost sure to be leakage at points where the stock enters and leaves the equipment. As already stated, if this leakage is reasonable it is not serious because the air can be diluted down with oxygen-free gas far below the danger point. In order to minimize such leakage it is desirable to maintain the pressure of the apparatus as nearly atmospheric as possible. It is practicable to operate under plant conditions with pressures within .02" of water of atmospheric. This is acomplished by using a slight excess pressure on the producer system so that the gas is delivered to the hood under slight pressure but is drawn away from the hood by a fan which develops the pressure necessary for the rest of the system.

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In starting up this sort of equipment one can arrange to sweep out all air from the apparatus before any solvent is introduced, thereby eliminating all possibility of explosion. Furthermore, in shutting down, one can wash out all residual solvent with flue gas and then the flue gas with a blast of air before operatives enter the equipment for repairs, thereby eliminating danger from toxicity.

It is believed that a wider use of flue gas in the evaporation of such solvents will greatly reduce industrial fires and explosions from this cause and largely eliminate industrial poisoning from toxic vapors. Where properly designed to meet operating requirements the elimination of danger can be accompanied, not by limitation but by increase in production. Fortunately too the best provision for safety makes possible easy recovery of the solvent which can be made to more than repay the expense of the whole installation.

DISCUSSION

MR. EVERETT F. KING (H. A. Hale, Jr. and Company, Boston): We keep a temperature of sixty degrees in the room, and all around the sides we have a steam coil, with jets of steam. Is there any other better practice that you can suggest in addition?

DR. LEWIS: I wouldn't enclose your spreader; do you?

MR. KING: We do enclose the drying part of the equipment. The fabric passes into the drying apparatus, and the heating coils and the ventilating system are in there.

DR. LEWIS: I have investigated plants both in England and in this country, and there is no question whatever but that in England the percentage of vapor fires is somewhat below what it is here and the only explanation I ever heard offered is the high humidity which they have. I certainly would recommend high humidity. Actually however, with covered spreaders, such as you have, and an adequate forced ventilation, I have never known a fire to occur.

CHAIRMAN TILLSON: If I understood Dr. Lewis correctly, in his paper, he told us that the gas which he would use to inhibit combustion would be satisfactory if it contained less than 12 per cent, by volume, of oxygen. The figure seemed to me rather surprising, and that preferably a factor of safety would be advisable, cutting down this figure to 6 per cent by volume of oxygen. It seems to me that you might have a little difficulty in obtaining such gas in the producer. Common boiler practice of efficient utilization of fuel and refraining from the production of carbon monoxide, would give you 50 per cent excess of air, and that would give you 13 to 14 per cent of oxygen in your flue gases.

DR. LEWIS: Modern boiler practice is moving toward lower percentage of excess air, than formerly; and today, in modern, well-run, boiler houses, 50 per cent excess air is excessive and unnecessary. Now, it is possible, in a well-designed boiler, to get oxygen concentration down below 2 per cent, without difficulty, and get good boiler combustion. You cannot use gas from an ordinary boiler for high-grade work, because it contains a certain amount of greasy soot, and it is almost impossible

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to prevent that occurring. Now by the use of a boiler, that can be entirely eliminated. In boiler combustion, we have two kinds of air—the air that goes up through the fuel bed, which is primary air; and the other which comes above the fuel bed, which is secondary. To produce oxygen-free gases, you must use a boiler in which the secondary supply is shut off. Under those conditions, you usually do get somewhere from 1 to 3 per cent of CO. If the conditions are bad, you can run the CO above that. It is entirely practical to keep the CO concentration below 2 or 3 per cent, and the oxygen concentration so small it is impossible to detect it.

CHAIRMAN TILLSON: The same process has been in my mind for use in the extinguishing of mine fires—that is, the production of incombustible gases, from a furnace, on a large scale, instead of attempting to buy carbon dioxide.

DR. LEWIS: In that connection, it would be necessary for you to reduce the oxygen content. In a gas containing less than 12 per cent of oxygen, a flame started will not propagate itself; but in a mine fire, you have a hot incandescent mass of material, and a gas containing very much less than 12 per cent of oxygen will maintain that fire because it is hot to start with, so that it would be necessary for you to get your oxygen content way down.

MR. KING: Is the problem of drying lacquers and japans similar to the problem which you have been stating?

DR. LEWIS: It is entirely separate from this. Very frequently the objects to which these lacquers are applied are of such a shape that it is almost impossible to enclose them within a space of reasonable size, while evaporation is taking place. It frequently makes the problem of drying lacquers very difficult. It has been solved in many cases, where the object was of such a shape that it could be handled within a reasonable confined space.

ELECTION OF OFFICERS

Upon report of the Nominating Committee the following officers were unanimously elected:

Chairman, H. W. Forster, Independence Bureau, Philadelphia.

Vice-Chairman, George T. Fonda, General Supervisor, Employment, Compensation and Welfare, Bethlehem Steel Company, South Bethlehem, Pa.

Members of Executive Committee for terms expiring 1924, L. A. De Blois, E. I. du Pont de Nemours and Company, Wilmington, Del.; B. F. Tillson, New Jersey Zinc Company, Franklin, N. J.; H. A. Schultz, Bureau of Safety, Sanitation, and Welfare, United States Steel Corporation, New York City.

ADJOURNMENT.

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Health Service Section

Joint Meetings with

American Association of Industrial Physicians and Surgeons

September 29 and 30, 1921

DR. A. W. COLCORD, Chairman
Carnegie Steel Company, Clairton, Pa.

DR. WM. A. SAWYER, Vice-Chairman
Eastman Kodak Company, Rochester, N. Y.

DR. A. J. LANZA, Secretary

THURSDAY MORNING SESSION

CHAIRMAN COLCORD: Our secretary, Dr. Lanza, is in Australia, occupying a very important government position, and organizing Australia for health in industry. We are glad for his sake, and for the sake of the people of Australia that he is there, but we lose him here; and in place of Dr. Lanza, Dr. Sawyer, our vice-chairman, will act as secretary.

Dr. Shoudy is the chairman of the Health Committee—the combined committee of the American Association of Industrial Physicians and Surgeons and of the Health Service Section of the National Safety Council. Dr. Shoudy, have you a report to make?

DR. L. A. SHOUDY (Bethlehem Steel Company, Bethlehem, Pa.): I was appointed to outline what the Health Service Section could do to be of value to the Council. We suggested a nation-wide health week for every city of the United States and Canada. We wanted to organize this from the National Safety Council and through the industrial surgeons carry it on to each state, and from there to each county and to each city.

The Executive Committee of the Council thought it would be a very fine thing, but they hadn't the money to do it. After that, the big thing was to put forth what we could in the line of health service talks through the *News*, and make ourselves useful in any way we could.

Dr. Colcord and myself still believe that it would be a fine thing, and would do a great deal of good, if we could put over a health drive in every city of the United States and Canada.

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CHAIRMAN COLCORD: This committee also contemplated a year round drive for better health in industry—a drive that would never stop.

We feel that it isn't doing enough to come here and speak in glittering generalities about health in industry, and then forget it the rest of the year. Those who come here are the fellows who don't need the inspiration of this drive. Every one of you is conducting a health campaign in in your own community; but the fellows who don't come, who are not interested enough to come, need this organized drive for better health in industry. We hope that a committee of this kind can be continued. We believe that something must and can be done to cut sickness in industry in half, and we believe that ours is a large share of the responsibility for health in the industrial towns.

DR. E. P. JONES (American Red Cross, Boston): My mission is to travel all over New England. I have visited a great many industrial institutions. I have found them very much lacking in regard to first-aid kits. In their emergency room (where there is an emergency room) they have an inferior lot of supplies and a few bandages, a little carbolized vaseline, etc. I should say, instead of a health drive make it health education, with the Red Cross collaborating with the National Safety Council, or the National Safety Council collaborating with the Red Cross. I am authorized to offer the services of the Red Cross in any way that it can be of benefit to this association.

CHAIRMAN COLCORD: I want to say in explanation that I didn't take the time to unfold our whole health plan, but one part of it was a great, big plan to co-operate not only with the Red Cross, but also with every state and local agency for health. The various health organizations could be all, in some way, concentrated on this health drive. We thought of the Red Cross as a very important factor in this campaign. The whole idea with us has been education. We want to get them to teach health in the schools, as well as safety, on a big, broad plan.

DR. C. F. N. SCHRAM (Fairbanks, Morse and Company, Beloit, Wis.): I move the work of this committee be continued for the next year at least.

(The motion was duly seconded and was carried unanimously.)

(Chairman Colcord then appointed the nominating committee, consisting of the following members: Dr. Ralph W. Elliott, National Lamp Works, Cleveland; Dr. G. H. McKinstry, Spang, Chalfant and Company, Pittsburgh; Dr. F. L. Rector, Conference Board of Physicians in Industry, New York City.)

The first paper on the program is by Mr. Newman, Managing Director, Philadelphia Housing Association, Philadelphia.

ADEQUATE RECORDS OF LOST TIME IN INDUSTRY DUE TO SICKNESS

BERNARD J. NEWMAN, CONSULTANT IN INDUSTRIAL HYGIENE AND SANITATION, PHILADELPHIA

In discussing this question, I am going to emphasize the following points:

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First: We have no adequate records of the lost time in industry today, due to disease.

Second: Adequate records are absolutely essential in order to reduce production costs.

Third: A simple record form has been prepared by the Joint Committee of the American Public Health Association and the Public Health Service, which is available for distribution.

Fourth: Even with a good record form and a good intent on the part of those who install the records, these records are of no value unless they are interpreted.

Fifth: The interpretation of the records is a problem of the state, and should not be indulged in by those untrained in statistical procedure, if they desire to get anywhere in the interpretation of the problems of the plant in which they are working.

We may assume there is a definite annual loss to industry due to sickness. Excessive insurance rates charged to workers in hazardous processes tend to confirm this assumption. Various sickness surveys which allege an annual loss equivalent to the full time yearly production of 23 to 25 workers per thousand employed, further strengthen this assumption. After these admissions have been made there is little reliable data to support the contention of a measurable loss, still less to aid in differentiating the prevalent diseases among industrial workers or the degree of responsibility resting upon sickness for high rates of absenteeism from employment, while there are even fewer data to aid in the analysis of the predisposing and exciting causes responsible for the occurrence and recurrence of specific diseases. There is some literature on absenteeism and industrial sickness rates, but it will not bear too close analysis as to the authenticity and completeness of the data, nor as to the thoroughness with which they have been collected and the accuracy with which they have been interpreted. After all has been said in favor of the work done, the plant manager's only sense of security in the deduction made is that in the majority of instances such deductions undoubtedly have not been exaggerated. In other words we do not possess today a reliable picture of the amount of lost time in industry due to sickness either of the worker himself or of the members of his family, and we cannot announce either the loss in plant production on the one hand or in wages on the other, resulting therefrom.

SCIENTIFIC FACTS NEEDED AS BASIS FOR STANDARDS

Moreover this same uncertainty is costly in other ways. It is notorious that many of the standards established by legislation to govern the sanitation of plants are founded upon guess-work. Out of the experience, or lack of experience, of well meaning persons, sanitary standards are often evolved. During the war when women were rapidly replacing men in industry, a group met in Washington to decide on what would constitute a maximum lifting weight for women workers. None in the group could visualize bulk and weight. To approximate uniformity in judgment, it is alleged the weight of a typewriter was guessed. Variations as high as forty pounds were made in the guesses. Yet this group set a tentative

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maximum lifting weight for women at 75 pounds. No distinction was made as to the nationality, size, or previous occupation of the women workers.

In like manner other standards have been set, not on the basis of scientifically ascertained knowledge but out of experience unrecorded and, of course, unscientifically analyzed. The fallacy of the method often goes to the other extreme in permitting standards that, in scientific study, are found to be dangerous, as is shown in the results of a study of wet grinding processes in an axe factory. Legislatures have permitted wet grinding as a safe operation. Yet Dr. Drury (See Public Health Reports on "Wet Grinding in an Axe Factory" 1920) finds a death rate for a period of ten years from tuberculosis alone in a Connecticut factory amounting to 19 per 1,000, whereas other workers in the same mill show a rate from tuberculosis of only 1.6 per 1,000, while the rate for the general population in the villages from which these mill workers were drawn (exclusive of the mill workers themselves) was only 1.2 per 1,000.

Manifestly the legislature and those who sponsored the legislation guessed wrong when they legalized wet grinding.

GUESS-WORK IS COSTLY TO INDUSTRY

Industry, as every other branch of human endeavor, pays a penalty when legal standards or private practices are governed not by scientific studies and the analysis of well established facts, but on the basis of guesses. Because industry is today spending sizable sums on plant improvements it becomes all the more important that the available sources of scientific analysis of plant working conditions be utilized to their maximum. These available sources are or may be made to lie in the records of the medical and surgical relief rooms and in data obtained from a study of plant processes and the hazards arising therefrom.

It is an axiom in industrial engineering that economy of production and operation cannot be effected until the influencing factors are known and their relative significance determined. No factor can be evaluated until it is known, and where it is made up of a combination of disorganized units, these must necessarily be collected, correlated, and analyzed, and the resultant deductions be given their proper weight. This is approximately what we do not have even in the best statistics available on sickness absenteeism in industrial plants. It follows, therefore, that the failure to produce comprehensive and reliable data in this field has deprived the industrial manager of the necessary information to guide him in the elimination of any losses that might be occurring in his plant due to sickness.

It is, of course, clearly patent that absenteeism, independent of its cause, is a loss when it results in the complete discontinuance of output in any department, if such output is essential to the full time employment of men or machines or power elsewhere. Moreover, it is a loss for a period, at least, when a substitute employee has to be broken in, or when he slows up production on his job until he has become proficient, causing interruption in maximum production all along the line and not infrequently involving "unemployment within employment" while, overhead

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costs continue unabated. It is a further loss when his labor results in spoiled work and wasted materials during his period of training or while he attempts to speed up before he has acquired the accuracy to make speed profitable. To all such possible losses, when sickness is the factor in absenteeism, may be added those losses which occur during the period of sickness-onset or attend convalescence when the worker insists in trying to work. Usually during such periods there is an increase in accident frequency and severity rates as well as an increase in wastage, because attention is less alert and mistakes of judgment are more likely to occur.

MEDICAL SERVICE AIMS AT PREVENTION

That some inkling of the fact that there are losses due to sickness has come to some of our larger industrial establishments is apparent from the extension of the functions of the plant physician. Primarily employed as accident-treating, compensation-reducing agents, they are now, in many instances, administering temporary relief during working hours and in some instances, through the nursing service, which they supervise, they are extending this assistance to employees in their homes.

The primary function of the relief room directed by the industrial physician has almost invariably been thought to be treatment. And yet here, as in all phases of public health work, while treatment is essential for the injured, it is more economical, in the long run, not to permit treatment to be an end in itself but to have it determine a policy of prevention. For example, a safety appliance on a circular saw is less costly than compensation payments for the loss of an employee's arm. And a physically fit grinder or polisher working on a well hooded and adequately exhausted machine is more productive than a dust-choked laborer handicapped by pneumoconiosis. In other words, while a relief room may make a record by reducing the number of re-treatments and by expediting healing of injuries, yet its greatest contribution to the efficiency of the plant comes through the elimination of the hazards responsible for treatment. In the majority of the cases which have come under my observation, this has not seemed to be the goal of the plant physician, and in my interviews with plant managers, following my observations of the restricted scope of work in relief departments, this has not been their concept of the functions of their surgical service, an attitude which may explain the restricted work of so many relief departments.

MEDICAL DIRECTOR NEEDS SICKNESS STATISTICS

Yet it is within the province of every plant physician so to direct the activities of his department as to educate and to assist the management to formulate a personnel and sanitary program that will radically influence procedures in the employment, supervision, and placement of workers as well as in the hygienic maintenance of workrooms and processes. But in order to do this he must know the losses resulting from sickness and accident among his own plant personnel. This he can only ascertain by keeping an account of the cases that come before him and by analyzing

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from time to time the data he has collected. In other words, in order to arrive at a basis of fact from which to build his program he must have adequate records.

This is so self-evident as to raise the question as to why it should be specially emphasized. The fact is that while it is admitted by those accustomed to scientific measurements, yet there is a large group who are unwilling to take the time to collect adequate data, or do not appreciate the value inherent in exact or approximately exact data. Industry is woefully deficient in its study of the human factors in production. I found this out when I directed the researches of the Office of Industrial Hygiene and Sanitation of the U. S. Public Health Service. Rarely did we find a plant that knew its sickness rates or its absentee or turnover rates. Time clocks were in some plants, others had no time checking systems, but if there were plenty of men available for employment, "men might come and men might go" and the going seemed to make little impression. When the pottery survey was begun, there were no records of attendance available, nor were there any authentic records of cases of lead poisoning. Fellow workers could remember of this co-worker or that, who had colic or wrist-drop or some other significant sign of having absorbed lead, but the plants had no data and even the records of state departments charged with industrial supervision were incomplete in so far as the number of cases of poisoning was concerned. Physicians did not report lead poisoning. The same absence of records was found in the foundry survey.

INADEQUATE DATA WORSE THAN USELESS

To secure a crude index of sickness and absenteeism we had to persuade the management to keep records on forms which we submitted to them. Not 15 per cent of the manufactories of all kinds that we visited over a period of years, and there were several hundred of them, knew their own sickness or absentee rates. Even when we did find records, they were almost invariably incomplete. One class of plants would have a roll book in which would be recorded the name and address of the sick or injured employee and the complaint treated. Apparently the record was only kept to show the number of persons treated. In other plants we would find additional data, but such essentials as age or nationality would be omitted. Still others, like one large steel plant, would have fairly complete data but would neglect to record the department in which the employees worked or, having this, would fail to secure a record of the attendance, number hired and fired by departments, so that the number exposed might be obtained from which rates could be drawn. Adequate records upon which to compute sickness rates or absentee rates, were as a rule not available. It is this seeming indifference to exact knowledge upon the basis of which plant personnel programs may be built, that makes the question of adequate records of significance, for records that do not tell the true story are worse than useless; they are unsafe and lead to all sorts of false deductions.

What, then, constitutes adequate records? I do not intend to outline the record itself. That has already been done by the U. S. Public Health

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Service in co-operation with the Committee on Vital Statistics of the American Public Health Association. Anyone interested may obtain a copy by writing the Surgeon General, U. S. Public Health Service, Washington, and requesting Reprint No. 573, "Sickness Records for Industrial Establishments." This form is divided into three parts: the first requires personal information, the second calls for occupational data, and the third gives the sickness history. The card lacks some items which will occur to the reader when he analyzes it, pertaining to the factors that might uncover certain predisposing causes for sickness, but on the whole it is sufficiently complete to assist any plant to determine time losses from sickness and the principal causes. The data card is 4x6 inches and allows plenty of space for the information to be recorded.

PUBLIC HEALTH SERVICE DATA CARD RECOMMENDED

Although some plants may find this card incomplete for their specific purpose, yet it is recommended for general use because the items cover the salient facts needed and do not take much time to record. Moreover, with many plants using the same form, comparable data may be obtained whereby alleged hazards of occupations may be checked and the efficiency of medical and surgical relief programs determined. If the same nomenclature is used in recording incapacitating diseases, there will be accumulated over a long period of time, a mass of data that will minimize errors of diagnosis and permit a better understanding of the actual diseases excited or accentuated by industrial processes or plant insanitation.

Of course, the value of all such records comes through their interpretation. One large corporation with thousands of cards consistently collected, just as consistently filed them away unanalyzed. They possessed an adequate staff but it did not function here. When it is beyond the training of the plant physician to organize and to interpret data so as to obtain more than the crude rate, technical assistants should be given his department for this work. But even a crude rate or, what is less difficult to get, simply the gross number of cases of like character may be made to tell a valuable story; yet, strange as it may seem, many plants have not made even such use of their records. I recall a visit to one plant where cases of industrial poisoning were suspected. The attendant in the relief room exhibited his records to show the plant was free from industrial diseases. But in the records for three months there were eight cases with symptoms very suspicious of aniline, considering the work place of the employees. On the strength of such records a survey of the aniline house was made. Many gross defects were found among which were pools of aniline on the floor.

In another plant, a white lead works, a series of suspicious symptoms had been recorded by the plant physician, but until our study was begun the medical director had contented himself with just recording his treatments. He saw nothing suspicious, in the light of his known plant hazard, about the prevailing symptoms he treated; that is, he did not appreciate that a specific symptom of lead poisoning was appearing among his men with more than usual frequency, and that such frequent reappear-

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ance should in itself be sufficiently suspicious to warrant a more thorough examination for further and more definite diagnosis.

CARE REQUIRED IN INTERPRETING SICKNESS RECORDS

There are many pitfalls to avoid in recording and interpreting plant sickness records. Very little reliance can be placed on crude rates obtained from a single table setting forth the amount of sickness in a plant as a whole. A low plant rate may hide a high departmental or occupational rate. A high departmental or occupational rate may be due to no unfavorable plant condition but to an excessive number of chronic cases in the working force. Or it may be racial, or a bad age distribution, or even to a combination of these causes none of which can be corrected without changing the personnel of the department. And the reverse also is true. A low rate may be due to a favorable grouping of age, sex, and race. When these are properly evaluated, it may be found that there is in reality an excessively high rate for the occupation or department or plant.

By the process of elimination and the weighting of factors according to their significance, the effect of various influences within and without the plant may be ascertained; likewise, the seasonal distribution and variations of sickness, the departmental or occupational distribution, the influence of community insanitation, or even the efficiency of the medical department itself may be approximately measured. It is quite feasible and may prove highly profitable to evaluate age, sex, and race, in the procurement of stability of employment or regularity of attendance among employees. With adequate data of sickness correlated with turnover and accident records, it is possible to ascertain the probable effects of working conditions and processes, or at least to indicate in what occupations and processes there may be hazards of insanitation or undue exposure to poisonous compounds, or workers subject to over-fatiguing labors.

PROPER RECORDS AID PLANT MANAGEMENT

With the clear diagnosis of the diseases treated, it is possible to get a disease prevalence rate which will make known the most common diseases, as well as the most serious, their frequency and their duration or the total lost time they cause plant employees, and may indicate causative factors therefore within the control of the plant management, or the incidence age of degenerative diseases in exposed processes. Furthermore, such data will tell if there are repeaters among the employees who are responsible for an abnormal sickness rate in the plant. It is quite possible that with records of sickness absence at hand, a transfer program may be developed for the employed personnel that will not only be humane but will be a decided contribution to the efficiency of the plant and show a measurable influence on production besides contributing toward the reduction of accidents with the attendant reduction of compensation costs. Such data may help to establish a check on losses due to malicious malingering among members of plant benefit associations or among compensation cases where industrial diseases are compensable.

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There can be no gainsaying the fact that adequate records of sickness among plant employees afford an opportunity to ascertain a number of facts pertaining to irregularity of employment and the cause responsible therefor[1] and permit the introduction of a program which will tend toward regularity in employment and toward an increase in production with a resultant decrease in cost of operation.

DISCUSSION

MR. C. F. HORAN (Hood Rubber Company, Watertown, Mass.): I believe Mr. Newman has very well brought out the fact that we are careless in the selection of our employees and that a system of record keeping on sickness and accident might give us some indication as to what kind of employees we want. When we want to buy a machine, we get up engineering specifications that will tell us what the speed of the machine is, of what material it is constructed and what work it will do. That goes to an approval committee, which approves all the engineering specifications. When we want an employee, we merely send an employment requisition through for one man or woman; and it seems to me that some day we will be giving the same degree of consideration to the engineering of human individuals that we now give to the engineering of machinery.

I am sorry Mr. Newman didn't give us some of his statistics. The Metropolitan Life Insurance Company in some of its surveys found that about ten days per year per employee were lost on account of sickness, whether preventable or not. Our costs at the Hood Rubber Company indicate that sickness constitutes one-third of the disability. If those two facts are comparable, it would mean ten days lost on account of sickness and twenty days' disability for other reasons. On a three hundred working-day period that would be ten per cent lost time.

At the Hood Rubber Company, every absence is reported to a central department each day. If an employee is absent more than twenty-four hours, a visiting nurse visits his home and gets a reason for his absence. We have tabulated statistics by departments, by cities and towns in which the employees live, by occupation, by nationalities, by age distribution, by sex distribution, by number of dependents, by length of service. We have also tabulations by physical examinations and classifications. We have used the international list because our figures are comparable then with death rates. Eventually, you will want to compare your industrial sickness rates with your industrial death rates, and if you don't have them on a comparable basis, you can't compare them. Likewise, the preliminary information has already been collected on the international list of causes of deaths, and you can get an index book with indices for everything you could possibly want to index. Then we punch a card for every disability. This card gives the number of days lost, the total lost time to date of that employee, the employee's average weekly wage, and his international list number for the disease or condition that disabled him.

To collect those statistics has cost us about eleven cents per employee

[1]See Report No. 539, U. S. Public Health Service—"Keeping Tab on Sickness in the Plant."

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per year. Mr. Newman has very well brought out the fact that if you are going to collect statistics you ought to collect them in a decent way. Poor statistics are worse than none.

It costs us about eighty-five cents per visit to absent employees; that includes the cost of operating the automobile, chauffeur's time, etc. For eleven cents, we have been able to keep exceedingly accurate statistics.

DR. SCHRAM: What is your sickness rate at the Hood Rubber Company in lost time per man per year?

MR. HORAN: We have been able to reduce our lost time on account of sickness to less than six days. Compared with the average lost time that the Metropolitan Life Insurance Company has given—ten to twelve and a half days—I think our statistics certainly would justify the work of our medical department.

DR. F. L. RECTOR (Secretary, Conference Board of Physicians in Industry, New York City): I would like to ask Mr. Horan whether the statistics quoted from the Metropolitan Life Insurance Company are the statistics of the surveys made in the different cities?

MR. HORAN: They were the statistics of the Eastern coal-mining district in Pennsylvania—that is, the anthracite district. They were collected by the National Industrial Conference Board. We also have some foreign statistics, but they have been collected with the idea of proving something; and what we need is some survey that would have in mind the idea of finding out something, rather than proving points.

CHAIRMAN COLCORD: A survey of the industries of Pennsylvania, made by a Government commission in 1919 and 1920 brought out figures of nine lost days per man per year.

ACTING SECRETARY SAWYER: What sort of treatment is the sick employee getting while he is out?

The Eastman Kodak Company inaugurated a sick benefit plan a year ago. We found a great deal of indifference to treatment, a great deal of bad treatment, and often no diagnosis when the treatment was being pursued. Now, if we find a sick employee who refuses to secure adequate treatment he is denied sick benefits and thus we have been able to influence them a great deal. We are doing this work through publicity, education, and personal contact.

MR. HORAN: I heard yesterday of a plant that made a survey of the number of disabilities and number of days lost time by individual employees, and they found that over seventy per cent of their lost time on account of sickness and personal reasons was among less than twenty per cent of their employees.

DR. GEO. M. PRICE (Joint Board of Sanitary Control, New York City): I understood you to say that a third of absenteeism is due to sickness. Roughly, would you tell us the causes of the other two-thirds of absenteeism?

MR. HORAN: What I should have said was that about one-third of our absenteeism is due to sickness or accident, and the other two-thirds will vary from forty per cent in one month to eighty per cent in another month, depending probably upon the baseball season, and other causes.

MR. C. B. AUEL (Manager, Employees' Service Deparement, Westinghouse Electric Company, Pittsburgh): The more we investigate this

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situation, the more I become convinced that if we had normal individuals as employees, a lot of these statistics would be unnecessary. I don't see why the manufacturer should be taken as a mark to shoot at, by a lot of these so-called welfare workers. There is a good deal to be said in favor of these investigations; but, on the other hand, they cost money, and you have got to spend money for an indefinite time before you can begin even to perceive the first concrete results. I don't know how the Hood Rubber Company is situated; it may be they have a single door through which employees enter and leave the plant. In our own plant, employing fifteen thousand people, covering acres and acres, and with many entrances and exits, it is almost impossible to keep a record of absenteeism with any degree of accuracy, unless it extends over a given period of time.

I have sat for over two years on the Morbidity Statistics Committee of the United States Public Health Service, which has been referred to, and it has been my privilege to help get up the card referred to. We are endeavoring to compile statistics commencing with the first of last January, on the subject of absenteeism. We have had to confine our investigations to the members of our sick benefit association, and will not record absentees under the first seven days.

I think you will be interested in the way in which we came to investigate sickness statistics a number of years ago. In compiling our accident statistics, we found that twenty-six per cent were due to carelessness. I suppose if you have given the matter any thought at all, you could assign a considerable number of causes of carelessness, but I think you will all agree that two of the most important are worry and ill health.

WORRY AND ILL HEALTH CAUSE ACCIDENTS

We passed up worry and began to concentrate on ill health. We found that the three principal causes of ill health among our employees are what may be called community diseases: tuberculosis, drunkenness, and venereal diseases. We tackled those three.

Fortunately the bone dry law came along and enabled us to drop our campaign against drunkenness, and concreate on tuberculosis and venereal diseases. That is something that can be undertaken by every concern with very little expense, and with very productive results. In the past five years, we have weeded out over three hundred of our employees afflicted with tuberculosis, and most of them have been sent to the state sanitariums in Pennsylvania, which are maintained at public expense. I find almost every state has one or more of them, where you can send your employees, without cost and I am glad to say in nearly all of those cases, the employees have returned to active service, not necessarily at the same job, but at equivalent jobs.

In taking up the subject of worry in connection with accidents, we found that the fellows' thoughts were largely on their homes troubles.

"Bill, how the devil did that happen?"

"Well, damned if I know. The missus was sick and the two kids hadn't slept, and I came to work in the morning, and the press came down and my finger went off."

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That with variations is the theme that determined us to commence home visits; and we have developed home visits, until now we make from five hundred to two thousand a month. We reached back into the homes and found a great many children suffering from tuberculosis, and some of the women folks.

MONEY SAVED FOR BENEFIT ASSOCIATION

A strange thing happened. We had no idea of saving money in taking up this work; but our relief benefit association's reserve was pretty badly eaten into by a street-car accident, involving some thirty-four of our employees, so that it dropped down considerably from the original figure of $100,000. We were worried about any further inroads upon it. Co-incident with this home visiting, that reserve started up $5,000 a month until it went to over $200,000.

What does that mean? It means that we were actually helping our employees, finding in some cases that they had not received medical attention and that in other cases they were receiving the wrong treatment.

We have been following up our accident cases. Our surgeons have actually been treating accident disabilities at home, so that it is safe to assume that we have cut down our accident compensation by these home visits, in the same manner that we have cut down the payment of sickness benefits.

In the matter of venereal diseases, you wouldn't believe how alarming the situation is. We hardly know what will be our next step, but I have told doctors, and I will tell them here, their charges are so outrageously exorbitant, it is like sentencing a victim to rot to death on his feet. The average employee cannot pay $50 a visit or a treatment for an innumerable number of treatments, and we have been more or less at loggerheads with the State Medical Association of Pennsylvania in trying to get these charges reduced. I am glad to say that we have finally reached a very friendy understanding with our particular county medical association, and we have made an arrangement with our own surgeons to treat cases off hours, at $3.00 per treatment.

Most of our employees belong to our sick benefit association, so that we can obtain certain statistics with regard to applicants for positions. We are compelled to reject about three per cent of the men and about ten per cent of the women applicants. The women largely suffer from malnutrition and bad teeth; while the men have bad teeth and rupture.

CHAIRMAN COLCORD: The next speaker is Dr. Paul White.

THE PROBLEM OF HEART DISEASE IN THE INDUSTRIAL WORKER

DR. PAUL WHITE, MASSACHUSETTS GENERAL HOSPITAL, BOSTON

Heart disease and industry are not incompatible. An individual may be productive even while beridden with heart trouble a large part of the time. The active trained mind of a cardiac cripple may be more

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valuable in industrial progress than a body in perfect health controlled by a dull intellect. In general we have all been inclined to shelter too much our young patients with heart disease. They can usually do more than we have allowed them to do. An example of the interest expressed in their own future as a group is a letter I received recently from a young man of twenty years, crippled since childhood by rheumatic heart disease, and unable to obtain for that reason, all the education he desired, and now facing the need of supporting himself without the best training for a clerical job. He is unable to do hard physical work and cannot obtain even light work because of the stigma of his heart disease. His plea for the future of the whole group of young people with heart disease overshadows all the rest of his letter. He is a champion of the cause.

There are two problems of heart disease in industry: first, that of the individual worker and, second, that of the attitude of industry in general. My subject is concerned particularly with the problem of the individual, but in closing I shall say a few words about the general relation of industry to heart disease.

WHAT CAN A CARDIAC CRIPPLE DO?

Every industrial worker with heart disease is a problem in himself. The solution of each problem depends on the answers to two short questions: how much work can the individual do, and what is his future? If we can puzzle out the answers to these questions we can solve the problem of heart disease in the individual industrial worker. The first question is a relatively easy one—to be ascertained at once by questioning the subject, by suitable tests, or by observing him while at work. The question would be better put as follows: "How much work can the individual do without discomfort?" for sometimes a person will force himself to do work often very distressing and even injurious to himself.

The other question is a very difficult one to answer at times, for the future of the case, or the prognosis as it is called, depends on a number of factors. First, a correct diagnosis is of prime importance and yet is very often neglected. Symptoms of heart disturbance such as palpitation (that is, the disagreeable sensation of the heartbeat), pain in the region of the heart, and shortness of breath, do not always signify heart disease by any means. Nor do fainting attacks or weakness indicate heart disease. Nor do murmurs or rapid heart action mean a diseased heart. And yet I have often seen patients diagnosed by themselves, by their relatives or friends, or not infrequently even by their physicians as having heart disease, when to all methods of examination their hearts appear normal. This has been true of sixty out of two hundred and forty-eight cases that I have seen in consultation (24 per cent) in the last two years. To be sure, some of these people are incapacitated by their symptoms even though their hearts are normal; the nervous system or thyroid gland may be at fault. Though it may be impossible for such individuals to carry on ordinary work, the heart should not be blamed and treated, and cardiac statistics be padded by these thousands of cases. Therefore the very first step in our problem is to make a proper

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diagnosis. That having been made in its entirety, the rest, even the forecast of the future, is not difficult. The other important point in answering the question as to the future of a given case is the study of the individual's reaction to medical treatment or to a definite test of work over a given interval of time. An hour, a day, or a week may suffice to answer this.

DIAGNOSIS AND TESTS DETERMINE PATIENTS' CAPACITY FOR WORK

Let me now take up these two steps—diagnosis and reaction to work—in more detail, since they are so vital in judging a case. Recently, diagnosis in heart disease has been put upon a sound basis and I shall discuss briefly the system as it is now in use in the heart clinic at the Massachusetts General Hospital and in somewhat similar form in some other hospitals. Because it is not widely used and because it has proved so useful, I want to emphasize its value in the industrial health problem. In former times, and not so far back either, as any one who received his medical diploma ten years or more ago will testify, heart disease consisted of mitral regurgitation and other such valve damage. A little was said about enlargement myocarditis and pericarditis. Disturbances of rhythm were beginning to be recognized in a hazy way, very shortly to flash up and take the lead for a while with such diagnoses as heart block and auricular fibrillation (absolute arrhythmia) sufficing as diagnoses of heart trouble. At the same time, Mackenzie's teaching of myocardial capacity was filtering in here and there, taught in a very disjointed way, unconnected with structural or etiological conditions. Now, more than ever before, we see the tremendous importance of the cause of heart disease as a vital part of our estimate of the heart's condition and particularly of its future. Finally, at the present moment the best diagnosis we can make consists of all three factors: the cause of the trouble (or etiology), the degree of anatomical damage, and the extent of functional impairment. Unless all these three points are studied and stated, I consider the diagnosis of a case of heart disease inadequate. By using this method, not only do we have a clear picture of the indivudual at the present time but also a very solid foundation for a prophecy as to his future. Each diagnosis should include then all available information as to etiology, structure, and function. If the cause of the heart disease is unknown, it should be so stated. Such a declaration of our ignorance will stimulate us to study the individual further and to search more deeply into the causes of heart disease in general.

CAUSES OF HEART DISEASE

The most common cause of heart disease are arterio-sclerosis and rheumatic fever with its allied infections such as St. Vitus dance and tonsillitis. Syphilis and thyroid disease are other important causes. It is of much value in estimating the future of a person with heart disease to know what caused the disease. For example, given three hearts with organic defects of equal degree, the future is as a rule much brighter if the cause is rheumatic fever than if it is arterio-sclerosis or syphilis.

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Until recently, syphilitic heart disease carried with it an especially bad outlook—often only a question of a few months of life. Now under better treatment the future is not quite so dark.

The next step in diagnosis is the determination of the actual degree of anatomical change so far as possible—the size of the heart, the valve changes, the involvement of the pericardium, and the presence of disease in the aorta. Careful physical examination, supplemented if necessary by X-ray and electro-cardiographic studies, will give a fairly good answer to this part of the problem.

And then finally we come to a very vital part of the diagnosis, the functional condition of the heart. Are there actual signs of heart failure such as swelling of the feet, or is there severe heart pain or shortness of breath in the presence of a damaged heart? If so, there is heart failure, that is, marked decrease in cardiac capacity. We speak of the type of failure with the shortness of breath and oedema as the congestive, and of the type of failure with heart pain as the anginal. Both are significant of serious heart damage and weakness. Of course, there may be much heart disease without failure, but sooner or later in such hearts failure becomes evident. All gradations of functional limitation of the heart's capacity exist, and following more or less closely the classification of the New York Association of Cardiac Clinics, we may speak of five groups of individuals with heart disease as follows:

1. Those able to carry on their habitual activities
2. Those able to carry on slightly curtailed activities.
3. Those able to carry on moderately decreased activities
4. Those able to carry on only greatly diminished activity
5. Those unable to carry on any of their habitual activities (without symptoms of distress).

Finally, under the heading of functional diagnosis are to be included the disturbances of rhythm, rate, and pressure such as heart block, auricular fibrillation, hyper-tension, and pulsus alterhans.

IMPORTANCE OF COMPLETE DIAGNOSES

A few examples will suffice to show the usefulness of this scheme of diagnosis. Take a man of thirty-five years of age who has a crippled heart following tonsillitis and rheumatic fever twelve years before. He had been diagnosed as having a leaky valve. After he has been carefully examined the following diagnosis is made: "Rheumatic heart disease with aortic regurgitation and slight mitral involvement, cardiac enlargement, with normal rhythm and able to carry on his habitual activities without symptoms." Now such a young man, although he has a loud murmur, may be able to live an active useful life of many years; only late in life may symptoms of heart failure appear. The fact that rheumatic fever was the cause of his disease, the fact that his aortic valve is involved with little damage to his mitral valve (mitral stenosis would be more serious), the fact that he has a regular pulse, and finally the fact that he has no symptoms of heart failure make such a young man a good risk for the future. The only things we must do with

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regard to him are to be sure that his tonsils are removed if they are in the least diseased or doubtful, and to avoid so far as possible further rheumatic infections (as a matter of fact best done by the tonsillectomy itself). There are many young people with heart trouble, about whom one may be as optimistic as I have indicated above, who are now being condemned as invalids and useless because they happen to have loud murmurs.

Take another man, one of forty-two years of age who begins to have heart pain on exertion. He boasts, perhaps, that he never was sick in his life, but on careful questioning he does admit that he had a venereal sore fifteen years before. On examination one finds his heart enlarged with a slight but definite degree of aortic regurgitation and a positive Wassermann reaction. His diagnosis is "syphilitic heart disease with aortitis and aortic regurgitation and cardiac enlargement and normal rhythm, able to carry on slightly limited activity." In spite of the fact that he may appear to be a robust man and have only a slight aortic murmur, his future is very serious at the present stage of our medical knowledge. This is all due to the fact that syphilis is the cause in this instance and not rheumatism. Once upon a time both of these men, the one of thirty-five and the one of forty-two, would have been classed simply as cardiacs with aortic regurgitation, the younger man with more marked valve damage than the older.

Finally let us suppose another man, twenty-seven years of age, with shortness of breath and palpitation on moderate exertion and occasionally when excited. His symptoms are much worse than those of either of the two cases already cited. He gives a past history of the usual children's diseases without rheumatic fever or St. Vitus' dance. He has always been high strung as his father was before him. His father is alive and well at the age of sixty-four years. The patient broke down at the front during the war after a long bombardment of his trench by the enemy. He was said at the time to have "disordered action of the heart." He has been more or less incapacitated since. People are afraid to give him work because of his symptoms and history. Yet he is well educated and bright. His diagnosis is "nervous heart and no evidence of heart diseases." He has a rapid heart-beat at times of examination, and under strain is unable to carry on his ordinary activities as well as normally. Now, such a man may be a very valuable one in industry. He is apt to be very quick to learn some delicate or intricate work and may accomplish much more in the end than his husky stolid comrade, who can do a hard day's work with the pick and shovel but who rarely has an idea pass through his brain. Let us remember this large group of keen nervous individuals who cannot stand a hard strain but who are able none the less to accomplish a lot. Such young men and women, in spite of their symptoms, will undoubtedly outlive the men with syphilitic and rheumatic heart disease. Our chief concern in such cases is to protect the sensitive nervous system. The heart is sound enough.

These three examples are enough to show, I believe, the great importanc of establishing a correct and complete diagnosis in each employee with heart disease. Sometimes a case is baffling, but if so let us confess

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it and closely follow the individual until we can arrive at the correct conclusion, if such is possible.

TESTS TO MEASURE CARDIAC FUNCTION

After the diagnosis has been determined, the other essential point in the proper estimation of a person's capacity and future is the actual test. Many articles have been written about testing the heart's function and some facts of value can be extracted from them. We must, however, realize that in a given case it is not necessarily the cardiac function that we measure with all our tests, but the physical fitness of the individual as a whole. His nervous system plays a part in his response to the tests as well as his heart and other muscles. The reaction of the pulse rate, blood pressure, respiratory rate, and general condition to measured exercise such as stair climbing, hopping on one foot, running a given distance, and swinging dumbbells has been studied and all these exercises have their advocates. Dr. May Wilson of New York has been attempting to find the "equivalent of ordinary exertion" by standard tests —particularly dumbbell swinging. Two iron dumbbells swung from the floor to full stretch of arms overhead and back again between the legs at a constant rate of two seconds for each swing were used in testing children from six to fifteen years of age. The weight of the dumbbells varied from three to twenty pounds, and the number of swings from ten to thirty. Thus in her classification mild exercise for the children of six to eight years consisted of swinging two one and one-half pound dumbbells ten times, while strenuous exercise for a child of twelve to fifteen years consisted of swinging two ten-pound dumbbells thirty times.

Now, by carrying this or some similar test a step further we may roughly correlate it to industry. If the measurement of physical action in a certain occupation can be figured in foot-pounds or kilogrammeters per unit of time, we may be able to arrive at some sort of an estimate of the cardiac capacity included in the general fitness of the individual by the test of a like amount of work in a unit of time in dumbbell lifting. Certain factors enter into such a test, however, that render it imperfect. In the first place muscles may be in use quite different from those exercised in the particular occupation; secondly, there is an added strain due to nervous excitement at the time of the test; and thirdly, the test lasts but a few minutes at the most while the job in question lasts hours every day. Thus only a very rough estimate of individual physical and cardiac ability can be made from such a test. Stair climbing, running, and hopping are all open to the same objections. There are no short cuts to determining the heart's power that I know of that are of universal value.

Respiratory tests have been suggested, such as the length of time the breath can be held, the height to which a mercury column can be blown, the length of time the mercury column can be maintained at a certain height, and the vital capacity. As in the case of the exercise tests, if these are normal the individual's heart cannot be very badly off. The vital capacity test, which is the measurement of the amount of air that can be expired after a full inspiration, and the test of holding the breath

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are useful measures of the degree of heart failure when such is present. Similarly with the carbon dioxide re-breathing test. But the only sure way to determine whether a man with heart disease can stand a certain job is actually to try him out at it.

THE JOB ITSELF IS THE BEST TEST FOR PHYSICAL FITNESS

No two jobs are exactly alike, and no two individuals have exactly the same kind or degree of heart disease. A few minutes, a few hours, or a few days at the most will answer our question. Having by observation, examination, and some simple test roughly determined the fitness of the individual, the exact measurement of his strength, cardiac and general, in relation to a certain job must come from the job itself. We must remember here, too, that it is possible to train a man for a job physically as well as mentally though he appears incapable at the first trial. There are occupations for all kinds of cardiac cripples. A man unable to climb a flight of stairs without shortness of breath is obviously unfit to work as a freight handler, but he may prove very useful in keeping the office files. A concise folder has been published recently by the Association for the Prevention and Relief of Heart Disease giving lists of occupations, both skilled and unskilled, generally suitable for people with heart disease.

Having finished this brief discussion of the problem of heart disease in the individual worker I should like to conclude with a few remarks on the problem of the relation of heart disease to industry in general. In the first place there is not, so far as I know, any *industrial* heart disease. There is, of course, effort syndrome, but for that industry is not to blame. The relation of industry to the production of arterio-sclerosis is still a question to be solved. Arterio-sclerosis is a very important cause of heart disease, and if years of hard work produce arterio-sclerosis, then industry may be accused of causing heart disease. The factors of the individual's susceptibility to arterio-sclerosis, of the exciting effect of hard physical or mental work, and of the time element of hours of work per day or week must eventually be studied and weighed before we can point out how industry may be relieved of the possible blame of inducing arterio-sclerosis.

PREVENTING HEART DISEASE IN INDUSTRY

In helping to eradicate heart disease, industry should insist on the proper physical examination of the worker. If the tonsils are diseased, their early removal may prevent rheumatic heart disease or prevent the increase of such disease if already present. It is very much worth while to try to eradicate rheumatic fever, for it is one of the serious scourges of the youth of the land. If there is a history of syphilis, or if the Wasserman reaction is positive, proper intensive treatment may prevent syphilitic heart disease. Proper education and campaigning against venereal disease (including the adoption of prophylaxis if necessary) will also help, for syphilitic heart disease, as I have already said, is a very serious matter. Early recognition and treatment of thyroid disease may

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avert thyroid heart complications. Avoidance of long sustained excessive physical or mental effort, and the insistence on regular periods of relaxation should reduce the degree of pre-senile arterio-sclerosis. People should live far longer on the average than they do, though the three hundred years of age advocated by the Barnabas Brothers in Shaw's "Back to Methuselah" is a bit too great a jump from our modest three score and ten to accomplish at the moment. To increase the average life, infectious disease must be eradicated, cancer overcome, and accidents and the strain of work be reduced. There is in general too high tension in American life, both in work and in play. We do not sit long enough at the breakfast table or over the teacups—we might do well here to take a leaf from the leisurely ways of the European. An engine run at high speed all the time wears out too quickly. The human machine, too, is liable to break down with a heart or a brain accident.

Not only may industry do its share in the prevention of heart disease, but it may also do its part in the prevention of heart failure in the individual worker who has heart disease. The tremendous improvement in the care of the health of workers made by industrial concerns all over the country renders it possible to check up frequently the physical condition of the worker with heart disease. By weekly or monthly examinations, or at intervals as circumstances demand, the earliest symptoms or signs of failure may be detected and proper recommendations as to treatment given. Rest in bed for a day or two at such a time may save the individual weeks of illness and loss of income later. It may prove to be very valuable insurance. Some of the cardiac clinics in New York meet on Friday evenings so that their patients may be advised to stay in bed for the week end if necessary, with little or no loss of time from their work.

Finally, let me repeat that heart disease and valuable productive ability may co-exist in the same individual. We must know the kind and degree of the heart damage. Knowing this we should be able properly to place the worker by using our common sense, the tests for a rough estimate of the physical capacity of the individual, and finally the actual test of the work itself.

CHAIRMAN COLCORD: It seems refreshing to find some one who can take a middle ground between the extreme of our old college teaching, and that of Sir William MacKenzie.

We will now have the discussion of the paper opened by Dr. Irving Clark.

DISCUSSION OF DR. WHITE'S PAPER ON HEART DISEASE IN INDUSTRY

DR. IRVING CLARK, NORTON COMPANY, WORCESTER, MASS.

About two and a half per cent of the Norton Company's employees have bad hearts. All those hearts are not heart diseases, but are hearts that we have to investigate to a certain extent and keep under control.

The outstanding teachings of Doctor White's admirable paper are:

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1. Be sure of your pathological diagnosis, and if you can't be sure, say so and keep on trying.

2. When hiring a cardiac for a job, if there is doubt in your mind as to whether he can do the work, put him on the job and watch him.

3. Most workers with cardiac disease can do more without harm to their condition than the average doctor realizes.

Though we can form some idea of his capacity from simple exercise tests, there is no test so good as putting a man to work.

My own small experience with cardiac cases, occurring in a factory averaging 3,500 employees over ten years agrees exactly with Doctor White's findings. At present there are 21 cardiac cases among 1,363 employees. Of these, 15 fall in class one, those able to carry on habitual activities; four fall in class two, those able to carry on slightly curtailed activities; and one falls in class four, able to carry on only greately diminished activities.

Of these 21 cases, nine gave a definite history of previous rheumatism, and three of serious infectious disease. We were unable to obtain a definite history pointing toward the etiology in the remaining nine cases. We have at present no case of syphilitic heart of which we know, though we have several cases of tertiary syphilis.

Our method for diagnosing hearts is as follows:

At the entrance examination we note the outstanding features of the case and place him temporarily. Some time during the week following, the case is summoned to the hospital and the examining doctor fills out the questionnaire which I pass around.

The tests of functional ability consist of 50 hops on one foot as an estimate of the reaction to moderate exercise, while lifting a 20-pound bar 25 times above the head is used as a more strenuous test. The reaction of the patient and the patient's heart is carefully noted. Each cardiac is reviewed carefully at least once in six months; of course much oftener if necessary. None of our cases is at present receiving any medication whatever.

Dr. R. B. Crain (Eastman Kodak Company, Rochester): At the Eastman Kodak Company, we are conducting similar examinations. The hop test seems a very unsatisfactory test, because men aren't inclined to hop with any vigor and the test rather falls flat, but swinging the iron bar, or raising iron dumb-bells, I think, is a fairer test.

I want to ask Dr. White just how the cardiac clinic of the Massachusetts General Hospital works in liaison with industry. If a man comes in with a cardiac disease, and diagnosis is made, how would the doctor get in touch with the proper industry to employ the patient?

We just started a cardiac clinic, using the blank laid down for the National Association for the Prevention of Heart Disease, and our problem at present is to get in touch with the various industries and get men jobs. In New York State the compensation law is rather stringent. If it can be shown that injury aggravates an existing heart disease, the employer is liable to pay compensation for whatever results in the way of sickness or death.

Mr. Auel: Let us suppose Dr. White is the examining physician for

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three such cases, applying for jobs, and he agrees that all three can go to work. Can you imagine Dr. White taking each of these three men out in the plant and endeavoring to explain to the foreman the kind of work each of the three must have where the work is not absolutely standardized? Can you imagine Dr. White running out there every little while to see whether the work has been changed? What manufacturers want is help in solving this real difficulty, as Dr. Crain has said.

In New York, likewise in Pennsylvania, if an injury aggravates a pre-existing condition, it is entirely the fault of the employer. What is to prevent one of these men from sayng that he tripped or slipped on a bar of iron or piece of pipe and doing it when nobody is watching? If asked by the referee: "Are you prepared to state that this accident which happened to the employee did not aggravate that injury?" Dr. White would say, "It might have", and at once the employer is at fault. In Pennsylvania a man working for a brewery was sun-struck and another working in a steel mill died of delirium tremens. In both instances the employers paid compensation on the ground that the pre-existing conditions aggravated the cases.

What employers want is help in this matter, and we want help from the state, so that if we are asked to take a sub-normal employee (I think and believe every manufacturer is willing to do his share), the state will help out in the event of disability happening to that man. Yet neither the state nor the United States will help us, if in endeavoring to do our share to rehabilitate injured soldiers, they incur further injuries.

I hope we will see compensation laws changed in some way so that they will recognize the extra hazard on the part of the employer, and compensate the employer accordingly.

Just one thing more. So far as I know there is not a compensation law that makes any provision for autopsy in the case of death. If an employee meets with a fatal accident and relatives say they don't want an autopsy, that settles it. All compensation laws should provide for autopsy.

Mr. G. A. Orth (American Car and Foundry Company, New York City): The Indiana State Compensation Law provides for an autopsy.

Mr. Frank Day (Philadelphia Electric Company): I would like to ask Dr. White if, in his judgment, it would be wise for an electrical power company to employ a man in any occupation where he might possibly receive even a low voltage shock, if that employee happened to be suffering from heart disease.

Dr. G. H. McKinstry (Spang, Chalfant Company, Pittsburgh): In Pennsylvania, any sudden death is subject to autopsy; I don't know why we need it in the compensation law.

Chairman Colcord: Dr. White will close his discussion.

Dr. White: In answer to Dr. Crain's question, as to how we are to place a man, I say we use our social service department at the Massachusetts General Hospital.

This last spring the cardiac clinics in the hospitals of Boston formed an association comparable to the Association of Cardiac Clinics in New York, although including only six or seven clinics. One function of this

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association is to study the industrial problem in relation to heart diseases. We have just begun to work and haven't advanced in any of these points beyond outlining a program.

In answer to Mr. Day, I don't know whether it would be safe to employ a patient or man with heart disease in an electrical power company. I don't see why he should be more subject to severe injury than a man without heart disease.

I want to say just a word again about the tests (functional tests) in estimating cardiac and general fitness. They are certainly valuable, and I think they should be used as the previous speakers have pointed out: but for the ultimate estimate of an individual's ability to carry on work, we must use the test of the work itself, I am quite sure.

CHAIRMAN COLCORD: The next paper on the program is by Dr. Cotton.

INFECTION OF INDUSTRIAL INJURIES

DR. FREDERICK J. COTTON, BOSTON

No one will doubt, I think, the great industrial loss of sepsis, nor will anyone dispute that most of this loss is preventable. I have no figures. Such industrial work as I now see consists almost entirely of referred cases sent to me for special examination or with a view to reconstructive surgery and such cases as come to my service at the Boston City Hospital. Anything like fair figures cannot be deduced from such material except as to the hospital.

A year ago I had the hospital cases of compound fractures looked up for a month—cases mostly coming to the outlying stations for first treatment, but also cases treated in the accident rooms and on the services. This short series happened to show about 15 per cent with more or less infection. "Appallingly bad," you say, "*my* hospital shows nothing like that." Well, neither did mine till I looked it up, and I don't think our average runs nearly so high. The point is that the general hospital *has* sepsis, and usually don't know much about it.

The general practitioner, treating many industrial cases in this state, has a not inconsiderable percentage of infections is not disputed, I think.

The *best* showing is in the big plant hospitals—those in charge, not of a nurse or orderly practicing medicine without a license, but under a real surgeon, properly backed up and held responsible for results.

All in all, in the cases of lasting disability I see later, I think it fair to estimate infection as the cause in 15 or 20 per cent, and in one-third to one-half of the cases showing wounds in the first place.

Why is this?

REASONS FOR FREQUENCY OF INFECTION

First, lack of prompt attention, due to lack of education of employees and to lack of facilities (e. g. no doctor to be had without a hunt for him, often with considerable loss of working time.) This is where the plant hospital wins out; even a first-aid station is worth something in cleaning and protecting minor wounds.

Second, personal uncleanliness, which I am growing to think a very important factor. A very large share of infecting bacteria come from

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the patient's own skin, and the incidence of infections seems to vary inversely to some extent with the patient's economic and cultural status.

Third, filthy surroundings. In big machinery plants for instance, there is little infective material; in a meat-shop infections are easy; among ice delivery men, minor wounds with tongs, etc., nearly always suppurate. We cannot do much with the surroundings, perhaps, but we can redouble precautions in cases of accident in unclean trades.

Fourth, too early use of the injured member, particularly in hand injuries, even if they have been properly dressed in the first place. This was an obvious factor during the flush times just after the war. Patients must often be bullied into giving up high wages for a few days or more on the doctor's advice.

Fifth, indifference. Sad to relate, there is a lot of sloppy work, largely due to the fact that much of the work is in the hands of youngsters who have not the experience to make them realize the appalling cost of sepsis.

Sixth, bad judgment. One must consider every case of accidental wound as *already* infected, and so treat it. This is *not* done.

Seventh, bad technique. This factor is enormously important but bad technique as practiced is largely due not to ignorance but to indifference and poor judgment. For instance, a good surgeon may get good results in compound fractures with iodine or with a scrubbing brush and corrosive or even alcohol. He knows what he is about. On the other hand I have seen a good many cases of septic fractures that had been treated with alcohol or iodine, and then sewed up, neat and tight, as if it were possible to get sterilization of an accidental wound complete enough for it to stay clean in the presence of blood clot and untrimmed rags of tissue in an hermetically sealed wound. That is rotten judgment, whatever solution is used.

TECHNIQUE IN TREATING WOUNDS

So far as technique goes it must conform to certain principles:

1. Wide exposure of the wound surfaces
2. Removal of devitalized tissues
3. *Prolonged* contact of the surfaces with the chosen mild antiseptic
4. Open drainage or at the most a loose suturing of the surface, whatever may have been done within—and, by the way, the less done as to repairs inside the better, as a rule. The prospect of a secondary operation in a clean field may well be balanced against even a chance of infection. This is particularly true as applied to bone injuries. The man who plates a fresh compound fracture, for example, is advertising for trouble.

Given these principles one need care less about how this or that man varies his detail.

One matter of sheer technic is worth discussing. That is the question of the Carrell-Dakin solution; not the question of later application, but of early use. In badly contaminated wounds, we should start with Dakin solution in a wide open wound and should not feel it a reflection on our ability to do this. No one can be sure of cleaning a filthy wound, and the time is coming when we shall recognize such prompt use of Dakin solution as an evidence of clear thinking, just as no good surgeon tries

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today to "get away with" close, neat suturing in contaminated wounds or omits his tetanus antitoxin in the doubtful case.

As to wounds already infected, the great factor of damage is reluctance (particularly on the part of the man responsible for the first dressing) to admit that they have "gone septic" and to get to work. A septic wound goes wrong very quickly as a rule—two days usually tells the story. The next two days will make or mar the result in many cases. Admit the facts, open up and clean out rigorously, and then get the two-hour Dakin irrigation started. It pays heavy dividends in the end, often reducing to an unimportant mischance what would be a disaster under the cover-up and argue policy.

So much for causes as I view them. What is to be done?

TECHNICAL SURGICAL ADVISER NEEDED IN MANY PLANT HOSPITALS

The responsible authority, whether plant manager, employer, or insurance chief, should take account of sepsis, should check up results of this doctor or hospital with the other and recommend accordingly, and *say why!*

Workmen are no fools, and if they realize that Dr. —— is named, and if they really understand that it is not because he will work for 50 cents or take the side of the company, but because he has shown better success in handling wounds, they'll make no difficulty—you may be sure of that. It is the same way as to general or local hospitals.

As to plant hospitals and insurance clinics, there is one thing worth noting. Experienced men are not needed nor are they available for daily routine. They are needed to consult and supervise routine and to consult directly on serious cases.

I believe every insurance company should have the benefit of some consultant of recognized standing and ability to advise on policy as it affects actual treatment of cases, to check up on the treatment of cases and the results of treatment, to oversee occasionally or periodically the work of the routine workers, and to advise on difficult or unsatisfactory cases. He should do no operating or direct treatment work unless in difficult special cases, and should be entirely divorced from the administrative or business end—a technical surgical adviser.

Not much of his time would be needed. A small portion of his time, if one had a man of the right type from the top row, would be a good investment and would help settle for the insurer a good many questions besides this one of avoiding the economic loss from septic infection.

CHAIRMAN COLCORD: Dr. Moorhead of New York will open the discussion.

DISCUSSION OF DR. COTTON'S PAPER ON INFECTIONS

DR. J. J. MOORHEAD, INTERBOROUGH RAPID TRANSIT COMPANY, NEW YORK CITY

To me, the primary cause of infection can be expressed by the single word "contact." This contact was the source of the wound, large or small as it may be. Contact enters again in point of time elapsing be-

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tween the injury and the treatment. Contact enters again in respect to the kind of treatment, immediate, intermediate, or late. From the time of injury to the time of restored function, the omissions and commissions in terms of contact make up the history of that case.

In reality this prevention and cure of infection relies on the known clinical fact that the pus producing germs thrive only upon devitalized tissue and that their saphrophytic activity does not commence until there has been an incubation period of several hours, probably not less than four or more than eight, depending upon the type of germ. Given this start of the infection, what sort of defense should we put up? There are only two weapons at our disposal—the two D's, disinfection and drainage.

CONSIDER A FRESH WOUND ALREADY INFECTED

Let us start our defense with the formula that every wound not made with surgical intent is already infected and should be so regarded. If we begin with this fundamental we readily pass to the question of methods of defense—what kind of disinfection, what kind of drainage? Here we are on controversial ground, yet the differences are not so fundamental or so strikingly different that we find no points in common. We need a consensus of opinion as to methods of defense, we need what we had in France, an inter-allied surgical conference board, to tell us the lessons of experience based upon past performances. It makes no difference what your personal belief may be as to the value of your favorite antiseptic unless you can show success with considerable uniformity. It makes no difference whether you use iodine, picric acid, alcohol or anything else if you bring your antiseptic into actual contact with the wound and literally drench the wound tract with it so thoroughly that enemy germs are killed as if by poison gas. Hence your warfare, like a blockade, to be effective, must be adequate.

Next, to provide a vent for inevitable secretion, we must provide suitable drainage. Corks have gone out of fashion surgically as well as socially; hence even if we use an alcoholic dressing, let us not seal in our secretion with a cork of gauze in our wound, but on the contrary use a rubber band or some other similar rigid means that will let things out and not keep them in.

An ordinary stationer's rubber band can be boiled—they come in all sizes—they can pass to the depth of any tortuous channel and they do drain. An ordinary pipe cleaner makes a fine drain.

Next, do not suture a ragged wound for 24 to 48 hours; if sutures are used at all they also should not seal, hence they should be interrupted. Your suture material passed along the bottom of your wound, entered at the top and coming out at the bottom, makes an excellent drain.

If you do not get infection in the first 48 to 72 hours you won't get any severe infection at all; if it comes later, it is latent or quiescent infection —or worse still, it is secondary or re-infection for which faulty technique is responsible.

HOW TO DISINFECT PUNCTURE WOUNDS

Learn to dress a wound with boiled instruments so that you do not touch the wound with fingers at all. If you have many to dress, get ac-

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customed to the use of ordinary household rubber gloves that cost 20 cents a pair, gloves that are big, gloves that you sterilize with your instruments, gloves that you can use over and over again. In those dangerous punctured wounds sterilize the tract by injecting into it with a hypodermic your favorite antiseptic—inject it until you make an antiseptic bleb; then if possible put in a tiny wick of a rubber band. Next, a wet antiseptic dressing, never carbolic. Next, some sort of a splint so that by use of the part no infection will be milked or spread along lymphatic or other channels, for infection will seek to burrow in unless you provide a tract of lesser resistance to let it out.

What about wounds already infected? Open these, but not too actively. Disinfect and drain these also. Do not make counter incisions except for well localized point pain, visible swelling, or actual fluctuation. Make an incision adequate at first and do not try to make this unless the patient is anesthetized, preferably by a general anesthetic. Never use chloroform in traumatic surgery; it is as dangerous here as it is safe in obstetrical surgery. Nitrous oxide, either by the drop method, or ethyl chloride drop by drop on a mask, are safe and adequate. Safety first in traumatic surgery, next simplicity—these are the roads to function and this last is the real goal of success.

STANDARDIZING PREVENTION AND TREATMENT OF INFECTIONS

Persisting infection means that the germs have a buried food supply and until we get rid of that we won't get rid of their products of activity. What is this food supply? First, frayed or devitalized tissue, especially muscle and fascia. Next, some forgotten or unexpected foreign body. Next, exposed bone. Here an X-ray is very helpful and we must not forget to use it early. If you find streptococci in any form of continuing sepsis, look for bone because that kind of infection is ordinarily connected with bone somewhere or somehow.

Let us standardize our attack, let us resolve that there is *one* best way to prevent infection, *one* best way to attack it after it has become established. Look at the treatment of appendicitis by analogy. There is one best way of treating that, minor points of technical differences not in the least offending or interfering with standardized procedures. It is time that the weight of authoritative experience placed the seal of approval on the *one* way of treating wound infection. Traumatic surgery is the great unexplored field of all surgery, it is the new field, it is the field that you men with your experience can properly harvest. Pathological surgery is well standardized in almost every direction. The growth of this new field is largely in your keeping, and standardization and uniformity of method will conquer this phase of surgery as it has conquered all others of surgical endeavor.

Dr. Shoudy: I was glad to hear Dr. Moorhead bring out the point that what has been considered minor surgery is really major surgery. I have always thought of hands and legs and arms as major-minor surgery. The point that struck me most forcibly in these two papers, was the importance of not suturing, and of keeping your favorite antiseptic in contact with the wound, which must be considered infected when it comes to us.

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This is borne out to me just as well with the smaller amputations, as it is with amputations of the arms or legs. I know from experience that if you pay a little more attention to the careful handling of the fingers, which after all are very important to the workingman, your results will be better.

Another thing: After you receive a case of that kind, it doesn't matter how small it is, you will get along much better after the amputation, if the finger has been properly dressed with your favorite antiseptic and bound up in splints for a support. Don't let the man say: "I don't want that." They don't like a splint; but it doesn't take you long to educate the men. Proper support in traumatic surgery is one of the big things toward returning the man in good order. I would like to hear of somebody's experience with these so-called puncture wounds and the injection of your favorite antiseptic.

Dr. McKinstry: Tetanus antitoxin should be used with all puncture wounds.

Chairman Colcord: We get many cases of puncture wounds, mostly wounds of the feet. We have at least two a week; and they are in the mill where we believe there are no tetanus bacilli. We do not as a routine practice give them a tetanus antitoxin. We might be criticized by those who would say the person's foot might have the tetanus bacillus on it, but in about eighteen years of this work, covering hundreds of cases of puncture wounds of the foot, we have not had a touch of tetanus. In regard to nail wounds of the foot, the nurses handle them very cleverly, under my direction. They cut an incision through the cuticle—a rather large incision—then the nurse takes a wooden probe and winds both ends, one with a large amount, and the other with a small mount of cotton, dipped in carbolic acid. This is worked to the bottom of the wound. Then the carbolic acid is wiped off with alcohol. This is a routine we have developed and followed for some years. I won't say we never get infection; but it is very rare.

In our work, an almost overwhelming proportion of infected wounds are due to delay. We keep a careful record of delayed cases, and charge them to the departments. If the number charged to any department becomes too large, we go after the superintendent.

We feel just as careful attention should be given a finger as would be given in the removal of an appendix. We do not use gloves. We make it a rule never to let the fingers get near the wound. Long handled forceps are used in dressing, as well as in removing gauze to clean the wound.

Dr. R. E. Andrews (Ludlow Manufacturing Associates, Ludlow, Mass.): Our work at Ludlow is in a textile plant. The jute is packed in India. In our plant it is carried through the rolling and spinning processes, and through the breaking and finishing cards, where it is subjected to many thousands of steel pins on drums or lags. Not infrequently our workmen get what seem to be minor injuries from these pins. The jute industry in Dundee, Scotland, is said to have tetanus as one of its hazards. During the process of packing the jute, very little heed is given to cleanliness, and there is the chance of the jute, coming to us from India, being infected. Tetanus is very common in India, and a number of cases have

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been reported from the Dundee factory. For that reason, it has come to my mind that it is absolutely necessary to use the antitoxin to prevent tetanus. I hate to have it admitted, but most perforating wounds from our lag needles are septic, and I have yet to find a thorough way of treating them to keep them sterile. These needles are probably one-third to a half inch in length. If a man's arm should be caught and badly perforated we are sure of a very severe shock following within four to six hours after the injury. This necessitates our waiting presumably from twelve to fifteen hours before much can be done, and if the injured man is etherized and operated on within two or three hours, he has the shock of the ether and operation plus the shock of the injury. The double shock has proved fatal in one or two instances.

DR. CRAIN: We don't have many puncture wounds in our industry, but those we have, we are in the habit of injecting with pure iodine, along the course of the puncture, using a needle probably one and a half inches long, which acts as a probe at the same time in following out the course of the foreign body. When that has been done immediately, we have had few wounds which showed infection. When the needle is withdrawn, the iodine is injected in a small quantity. It is well, of course, to know the size of the wound underneath the skin. If the wound has an opening beneath the skin of some size, it is a good plan to inject a lot of iodine, to have a pocket of iodine; sometimes that will form a slough. A needle wound would seem to be an ideal case for this injection, providing you first removed any foreign matter.

CHAIRMAN COLCORD: I will ask Dr. Cotton if he uses Dakin's solution as a matter of routine in his treatments.

DR. COTTON: As a general practice, I do not use Dakin's solution except where there are clinical signs of sepsis. Ever since my war experience, I am a firm believer in the usefulness of Dakin's solution, although I don't think it is the best thing we have.

ADJOURNMENT.

FRIDAY MORNING SESSION

CHAIRMAN COLCORD: The first thing on the program is the report of the nominating committee.

DR. ELLIOTT: Mr. Chairman, the nominating committee reports the following nominations: For chairman of this section, Dr. R. S. Quinby, the Hood Rubber Company, Watertown, Mass.; for vice-chairman, Dr. R. B. Crain, Eastman Kodak Company, Rochester, N. Y.; for secretary, Dr. R. P. Albaugh, Bourne-Fuller Company, Cleveland.

(On motion duly made and seconded, the report of the nominating committee was adopted and the nominees elected.)

CHAIRMAN COLCORD: We will now proceed to the scientific part of the program, and it gives me great pleasure to introduce to you, Dr. R. R. Sayers.

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TRANSPORTATION OF THE INJURED IN THE MINING INDUSTRY

DR. R. R. SAYERS, CHIEF SURGEON, UNITED STATES BUREAU OF MINES, PASSED ASSISTANT SURGEON, UNITED STATES PUBLIC HEALTH SERVICE

The importance of transportation of the injured can hardly be overestimated, it being second only to that of emergency treatment or first-aid care of the patient. During the last few years the transportation of the injured in the mining industry has undergone marked improvement, probably due chiefly to the education of the workmen in first aid. The U. S. Bureau of Mines alone has trained during the last ten years over sixty thousand miners in first-aid methods, which includes training in transportation of the injured, not to mention those trained by the American Red Cross and private organizations.

(Dr. Sayers' paper was illustrated by stereopticon slides.)

METHODS OF TRANSPORTATION USED TWENTY YEARS AGO

As an illustration of the conditions existing twenty years ago, consider the two prospectors who lived in the one-room log cabin in the Crowfoot Mountains of Montana twenty or more miles from the nearest town or physician. All supplies had to be taken in by pack mules or pack horses over a trail and the ore taken out in the same way. If one of the miners was injured, his partner would care for him as best he could or, if the injury were severe, might try to take him out to a hospital or physician. This he would likely do by preparing an Indian travois made by cutting two poles 16 to 18 feet long, laying them side by side, and connecting them by two crossbars, one 6 feet from the end and the other 6 feet farther back. The bars were fastened to the poles by nails, bolts, or wrapped with cords. Between the two cross pieces, lacings of rope or a blanket were placed for a litter. One end was then attached to the horse's saddle girth similar to shafts and the other end allowed to drag on the ground. It required two or more days for the long tedious journey and even when they reached a point where they could get word to a hospital to send an ambulance, a slow-going, rough-riding, horse-drawn, iron-tired vehicle was the best to be had.

DIFFICULTIES OF TRANSPORTATION IN THE MINING INDUSTRY

Your attention is called to the inherent conditions in the mining industry, not found in other industries, which make transportation of the injured very difficult. As an example, consider the Homestake mine at Lead, South Dakota, with its eight shafts varying from 800 to 2,200 feet in depth and over 60 miles of connected underground workings. If a man is injured in one of the stopes of this mine several floors above the level it is a real problem to get the man safely to the level and even then there may be obstacles to cross, as discarded timbers, boulders, etc. If there is a hoist or winch at the top of the raise, the patient, if properly prepared, may be either raised or lowered to a level, but such hoists do not exist at all raises. Supposing the patient to have been lowered to a

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level and to have been transported to the main shaft, it is usually found necessary to place the patient in almost an upright position, due to the smallness of the cages in metal mines, in order to take him to the surface. In coal mines, however, the cages are usually large enough to allow the patient to be laid down.

While this very brief outline of conditions in mines has only considered those producing metal, our coal mines, though not so deep, have fully as extensive workings, and the transportation of the injured presents problems, due to the thinness of the seam or to other conditions, practically as great as in metal mines.

PRESENT METHODS OF TRANSPORTATION

CARRIES. If we suppose a miner has been injured with only his buddy or partner present and immediate transportation seems necessary or advisable to get the patient to a place of greater safety, the partner may choose any one of several methods, as dictated by the existing conditions.

Fireman's Lift—The fireman's lift or across-the-back carry is easy for the bearer and is probably familiar to many of you, as it has been shown in the movies many times. One method by which it is performed is as follows: The bearer turns the patient over face downward and then places himself at the patient's head, facing him. He then passes his hands under the patient's armpits and lifts him to his knees. The bearer's hands should then be shifted lower down and clasped behind the patient's back. With this grip the patient may be raised to a standing position. The bearer supports the patient, places his left leg between the patient's legs, and grasps the patient's left hand in his right, bringing the patient's arm around the back of his neck, meanwhile holding the patient close to his body. He then passes his left hand between the patient's thighs, kneels on his right knee, shifts his left shoulder to the patient's abdomen, and grasps the patient's left hand in his own left hand. The bearer, after balancing the patient properly, rises. He may then secure the patient's right wrist in his right hand. By this method the patient is held securely over the bearer's left shoulder. If the bearer desires to use the right shoulder instead of the left, instructions as to which hand and leg to use would be changed accordingly.

Carrying in arms—If the patient is conscious or regains consciousness, he will object to being carried by the above method and the bearer will have to resort to carrying in arms or carrying astride the back. When carrying in arms, the bearer first raises the patient to an upright position, kneels on one knee and allows the patient to rest on the other; meantime supporting the patient with one arm around the body, he passes the other arm under the patient's thighs and rolls him into the hollow of the elbows and rises. This method is very easy for the patient but difficult for the bearer.

Carrying astride back—If the bearer prefers to carry the patient astride his back, he should do this by raising the patient to an erect position and supporting him by passing one arm around the waist. If his wrists have not been tied together the bearer should put the patient's arms behind his neck and over the shoulder and grasp his hand. The bearer's position

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should now be shifted from directly in front of the patient toward the side desired, thrusting the corresponding knee against one or both of his knees to prevent their bending. He then shifts quickly to the front of the patient, back toward him, and bends forward until patient rests upon his back. The bearer now grasps each of the patient's thighs and by a humping motion raises him to a position well up on the back. He then passes one arm under each thigh. If the patient's wrists have not been tied together, his arms are crossed over the chest of the bearer and one of his wrists grasped in each of the bearer's hands. When the patient is conscious, he can assist materially in getting the position for this carry.

Drag carry—If the man was injured in a low place as in a thin seam of coal, the bearer may use the drag carry until he reaches a place where he can stand erect. In this carry the injured person is placed on his back, the ends of two cravat bandages are tied together, making a loop, and the loop passed over the patient's head and down so that it will be under his back and around his sides at the armpits; the bearer then gets on his knees, straddling the injured person, passes the loop over his own head, and then, by crawling, drags the patient out. Occasionally this purpose is accomplished by tying the person's wrists together. The rescuer then passes his head between the arms.

Two-handed seat carry—Where two bearers are present, the two-handed seat carry may be used, especially if the patient is conscious. The bearers kneel on each side of the injured person, near his hips, and raise him to a sitting position. Each then passes one arm around the patient's back and the other under his thighs, the bearer on the patient's right grasping with his right hand the left wrist of his companion, the bearer on the left grasping with his left hand the right wrist of the first bearer. Both rise slowly from the ground and lift their disengaged hands to each other's shoulders, thus forming a back rest for the patient; or, unless the patient is helpless, he may support himself by placing an arm around the neck of each bearer.

Carrying by extremities—If the patient is unconscious, carrying by the extremities will probably be used, but is not usually applicable where there have been fractures or other severe injuries to the limbs. For this carry, one bearer takes position between the patient's legs and the other at his head, both facing toward his feet. The rear bearer raises the patient to a sitting position, and clasps him from behind around the body under the arms, while the front bearer, standing between the legs, passes his hands from the outside under the bent knees. Both rise together.

STRETCHERS

The above methods of transportation are only suggested for use where more help is not available. If the patient is in a safe and fairly comfortable place or has been transported to such a place, it is advisable to secure ample assistance and materials rather than to try to transport him alone or with inadequate assistance. For the severely injured, stretchers are almost indispensable.

Army stretcher—If we suppose our man has been injured in a coal mine, an army stretcher or litter, as it is sometimes called, will probably

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be available. This consists of two long poles with a bed of canvas between, the poles being held apart by hinged iron bars.

Improvised stretchers—Stretchers very similar to the army type may be improvised by using two drill steels, or poles 7 to 8 feet long, and a blanket or other material of similar size and shape. After spreading the blanket out, place one pole about a foot from the center, fold the short side over the pole, and place the second pole on the two thicknesses about two feet from the first, then fold the remaining part of the blanket over the second pole toward the first. Before placing the injured person upon an improvised stretcher, it should be tested. In this case the folds of the blanket are locked by friction when the weight of a man is placed upon it.

Another very satisfactory improvised stretcher can be made by using poles similar to those described above and two or three coats, the coats being turned inside out and the poles passed through the sleeves. The flaps of the coats are then turned down around the poles and buttoned underneath.

Improvised stretcher splint—If our patient had had an injury to the back, a dislocated hip, or fractured pelvis, an improvised stretcher splint would probably have been used. This consists of two boards 8 feet long, 4 inches wide, and 1 inch thick, and three short ones 18 inches long, 4 inches wide, and 1 inch thick. The long boards should be placed parallel to each other about 4 inches apart, and the three short ones either nailed or lashed to the long ones at a level with the patient's shoulders, hips, and ankles. After padding the two long planks, the patient is secured to the splint by cravat bandages about the extremities and body. This stretcher is very useful in bringing an injured man down vertical manways or in hoisting him up shafts.

Stokes navy stretcher—If the injured man was a metal miner, a Stokes navy stretcher would probably have been used. The Stokes navy stretcher is a wire-woven basket made to fit the human form and is equipped with straps to secure the patient in the stretcher. He may then be raised or lowered in a vertical position without injury.

Homestake stretcher—Another stretcher used in metal mines is the Homestake stretcher, which is made of a solid plank about 7 feet long and 1 inch thick, and cut to correspond somewhat to the body. It has a foot board on which the patient may stand when being raised or lowered. He must be securely strapped to the stretcher, however, before transportation is undertaken.

Stretcher drill—To carry a stretcher properly men should be carefully trained in its use. The stretcher drill recommended by the United States Bureau of Mines is practically the same as that used by the American Red Cross and military and allied organizations.

There are four bearers in the squad and a captain. Their duties may be learned more easily and to a better advantage by studying a diagram of a drill than from a description. In actual practice two men quite often carry the stretcher, but if two other men are available and are placed on either side, they will protect the injured man and may prevent him from falling should something happen to either of the other two bearers. Three of the men are taught to keep step at all times while the

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fourth is out of step. This prevents the swinging motion which is often quite annoying to the injured.

Ambulance Cars—While carrying an injured man on a stretcher is a good method of transportation, any carry becomes tiresome if the distance is a few thousand feet as often is the case in mines. Further the injured man suffers much due to missteps, caused by the rough roadway and poor lighting found underground. To avoid the above objections some mines are equipped with ambulance cars for transporting injured men when underground. An example of this is found at the Seneca mine of the Calumet and Hecla Company. This ambulance car is nicely upholstered and equipped with springs.

Another type, used by the Homestake Mining Company of Lead, South Dakota, is similar to a two-wheeled cart, is pulled by hand, and not intended to run on the car tracks. It is equipped with springs and covered. In some cases it may be necessary to take the man out to prevent water, dirt, or small rock from falling on him. The cover is a protection from these.

A practical method of improvising an underground mine ambulance is to equip an ordinary mine car, used regularly for hauling the coal out of the mine, with four springs. The springs are attached to the upper edge of the sides of the car near the corners and the stretcher suspended in the car from these springs. This method can be used in most of our coal mines. The springs should be placed with the stretcher so that both may be obtained at the same time.

Another practical method is to place on the electric locomotives two leaf-springs to support an ordinary army stretcher. The springs should be kept with the stretcher. After reaching the surface by any of the above means of transportation the patient is usually placed in a motor ambulance and rushed to a modern well-equipped hospital even if in a desert country.

DISCUSSION

Dr. Elliott: We have no seriously injured people in our industry, possibly because we are in a non-hazardous occupation. However, in case somebody has to be transported because of a faint from the heat or something of that type, we have a stretcher as a part of the elevator equipment in our buildings.

The stretcher is in charge of the elevator operator, and we find that this is the most convenient place in the whole factory for stretcher service. The elevator man is responsible for having a man on each floor to help him carry the injured to the dispensary or plant hospital.

Dr. M. E. Griffiths (Pittsburgh Steel Company, Monessen, Pa.): Transporting the injured is largely a matter of common sense and doing it as easily as possible for the patient. We have an ambulance that we transport our cases from the mill with. The distance to be covered is about ten miles. It is reasonably good road, and the ambulance is a good one.

One thing I might offer in that connection is the method of preparing fractures for transportation. I believe that every man that does industrial surgery and handles fractures, in order to qualify for that position,

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should have his own leg broken. I practiced surgery for a good many years before I had my leg broken. After that, I am sure I transported cases with fractures very much better for the patient, than I did before.

Our method is to use a stretcher. By the way, there is an improvement on the stretchers that we have recently adopted in our mill. It is a stretcher that has two poles, the same as the ordinary army stretcher, except that a canvas strap is in the middle—simply a plain leather strap that runs through the stretcher in the middle, and is pulled out after the patient is put on the balance. A part of that stretcher goes over one side and the other half goes on the other side and the strap runs through the loops. Then you pull out the strap when the patient is placed on the bed (after he is transported to the hospital) and he has no pain.

That means a good deal. Moving the patient from the stretcher to the bed is a matter that causes much pain in many instances when it is done in the ordinary way. Our method of transporting fractures is to tie the man to the stretcher.

I do not advise the use of splints and various other means of fixing a fracture before it is transported. I believe that the splint is a most excellent appliance, and it is perhaps a very good way; but I think it is better to pack that fracture in excelsior or waste of any kind and tie that leg to the stretcher. When you do that, the stretcher and the leg move with the ambulance. When you put the fracture in splints, it does not do that. And while I am not sure that a fracture can not be handled with the Thomas Splint, just as well as the other way, the other is much simpler, more easily done, and you don't need anything but bandage and some waste.

Dr. Shoudy: I think you have to divide the problem of the transportation of the injured according to the distance which you have to transport the same man. In the mining sections, it is more of a problem; you have only about five or ten minutes to get the man to the hospital.

In the short haul distances, where a man has to go only a short distance, the blanket split, or the pillow split on the long bones, especially on the legs, after you have made him comfortable, will serve amply for all you need to do. On the longer hauls we have been inclined to use the splint. If a man has to go a long distance, say five or six miles, in the ambulance, we use the splint for his fractures. I have never tried what Dr. Griffiths just suggested of strapping him to the stretcher.

Dr. Neal, of the Reading Coal Company, brought out a point in putting on the Thomas Splint, or in placing a man's leg in the long splints. The question of whether or not, after you have done that, to tie the two legs together comes up. If you would leave one leg free, he could use it to break the fall. That is to be considered when you transport men from a distance.

Chairman Colcord: I haven't had experience in mine surgery, but it has occurred to me that the type of stretcher that we use in our Carnegie Steel Works would be very well adapted to lifting the men from the mines. It is quickly applied, it takes up very little room when packed away, it holds the person fairly rigid, and there is a place on it to attach a rope.

It is used in all work in getting men down from a great height. When

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a man is hurt away up on a blast furnace, it is very convenient with a pulley to tie the straps right around him and let him down. It can be done with perfect comfort to the injured man. The same type of stretcher is being used in the British Navy in letting men down into holes.

In our work we also use a stiff stretcher covered with canvas, and then outside of that, a very heavy washable rubber cloth. The cloth of stretchers becomes soiled so frequently that we often find that they have become uncleanable, and we therefore use this heavy rubber cloth, which we find is very convenient in keeping a clean stretcher.

This stretcher was devised by Mr. Davis, our general superintendent, and myself. Under it is a pocket for keeping the blanket, so that when you send your patient to the hospital on this stretcher, the blanket is always returned with the stretcher.

DR. SAYERS: The United States Bureau of Mines, the American Red Cross, the National Safety Council, and the United States Public Health Service have all gotten together and we have standardized first aid, as far as the mining industry is concerned. We have just finished revising the American Red Cross first aid text book and the United States Bureau of Mines text book for mines. These are now identical.

I would like to see all industries that use first aid at all, or expect to use first aid, get together and use one common first-aid.

We believe in placing all fractures in splints, and we do that because it takes a long time and the patient has to go over rough ground before he is taken out. We do not tie the feet together, except that if they are being raised or lowered out through a man-way we tie the feet together and tie the arms down.

CHAIRMAN COLCORD: The next address on our program will be by Dr. C. L. Bradford, of Pittsburgh.

DISEASES AND INJURIES WITH SYMPTOMS REFERABLE TO THE LUMBAR SPINE

DR. C. L. BRADFORD, PITTSBURGH

In considering some of the many pathologic phenomena which give me the most annoyance in connection with industrial injuries, I selected this particular one, as in going over my records I was astonished at the tremendous proportion of patients which were referred to me after an unusually extended period of disability, giving symptoms referable to the lumbar spine area; likewise the diversity of pathology which was responsible for these symptoms.

In speaking of symptoms, there is a certain definite group commonly associated with disability or discomfort in the lumbar spine region. Briefly they are *pain, hyperaesthesia, anaesthesia, alterations of heat sensibility, rigidity, hypermotility and crepitation.*

Pain in the lumbar spine area is the result of a diversity of pathology, probably unequaled elsewhere in the body, nor is this surprising, as this segment of the spine bears the whole weight of the trunk, upper extremities and head, housing at the same time a structure so fragile as the

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spinal cord and giving egress to some of its important branches, yet furnishing an extremely flexible and efficient series of joints for the transmission, diffusion, and change in direction of forces applied from any angle. The lumbar spine and its associated soft parts do a tremendous amount of work with wonderful efficiency. A study of the literature which one would naturally expect to prove illuminating shows it singularly deficient in recognition of the importance attached to pain incidence in this region and its always associated pathology. Possibly the very multiplicity of conditions inducing symptoms in this area has militated against the careful investigation which is necessary in making a diagnosis of the actual etiologic factor in any given case.

SYMPTOMS

Hyperaesthesia—nearly always a reflex due to pathology within the pelvis or abdomen, but occasionally the result of local nerve irritation, radiculitis, or organic cord pathology, and not infrequently associated with a psychosis.

Anaesthesia—due to a true cord lesion, or perhaps oftener to the condition which, for lack of better knowledge, we call hysteria or traumatic neurosis.

Alterations of Heat Sensibility—always due to cord lesions.

Rigidity—muscular, as in lumbago, or atrophic, following fixation artificial or pathologic; bony, as in the hyperplastic, arthritic, and periarthritic conditions; inflammatory, where both soft parts and joint structure are involved with an acute infectious process or mechanical injury.

Hypermotility—pathologic only when involving special parts unequally, as in luxation or rotation of one or more segments, and due to excessive relaxation or destruction of soft parts.

Crepitation—resulting from arthritic, periarthritic, or bursal adhesions and joint irregularities.

DISEASES AND INJURIES WITH SYMPTOMS REFERABLE TO LUMBAR SPINE AREA

Diseases and injuries with symptoms referable to the lumbar spine area naturally divide themselves into two general classes—those directly involving the anatomic structures here present, and those indirectly or by reflex so resulting.

The local conditions, or those directly involving the structures in this area, are, for the purposes of discussion, better considered in certain groups,—as for example:

1. Mechanical injuries; contusions; ruptures of the soft parts; fractures; dislocations and combinations of all these.
2. Mechanical injury associated with other pathology,—as infection; developmental or senile, peculiarities or changes; tumors; hyperplastic or atrophic involvement of the bones or joints.
3. Infections (local); periarthritis; myositis; bursitis; thesitis.
4. Tumors—primary and metastatic, benign and malignant.
5. Arthritis—hyperplastic, deforming, atrophic.
6. Lumbago.
7. Radiculitis and neuritis.
8. Developmental peculiarities.

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Those indirectly or by reflex producing symptoms:

1. Injuries involving the structures above or below, causing alterations in lumbar posture or direction of force application.
2. Such conditions in association with other pathology, as with direct injuries.
3. Infections or intoxications of other tissues, as typhoid, influenza, etc. Toxaemias having no recognized etiologic factor.
4. Debilitating diseases, especially those associated with subacute or chronic low-grade infections, inducing symptoms largely through fatigue.
5. Changes associated with or incident to age. The developmental diseases in childhood; middle age inability to change readily; senility.
6. Developmental diseases not local peculiarities.
7. Pathologic conditions of other structures or organs causing reflex pain.
8. Sacroiliac disease.
9. Psychoses or traumatic neuroses.

PROCEDURE FOR DIAGNOSIS

It is evident, from this multiplicity of diseases and symptoms, that efficient treatment must be predicated upon an exact diagnosis, and in arriving at this diagnosis certain more or less definite procedure is desirable.

HISTORY

In making an examination of a patient complaining of symptoms involving the back, a careful and complete history should first be acquired —one which not alone considers the particular condition complained of, but carefully ascertains every possible contributory feature—as age, sex, other illnesses or diseases—especially the acute infections, such as abcesses or other pus infection, typhoid, influenza, gonorrhea, syphilis; also the presence of or the history of the removal of a malignant growth, especially carcinoma; previous similar attacks in this location or elsewhere—that is involving other joints, connective tissue or nerves; the presence at this time of such other tissue involvement; the exact character of the onset; the association of mechanical injury either immediately previous to or at a somewhat distant period; occupation; environment; habits.

PHYSICAL EXAMINATION

After taking this careful history, the physical examination should be as thorough and searching in its efficiency. To begin with, the patient should be stripped and inspected, standing—when irregularities in contour, such as scoliosis, kyphosis, lordosis and other departures from the normal anatomic relationship may be noted, as also posture. The other joints, and especially those of the digits, should be investigated for hypertrophic nodules. The presence of operative scars or existing tumors should be noted; also scars of herpatic eruptions, or the presence of such eruptions; other skin lesions suggesting syphilis, tuberculosis or other general maladies. The motility of the various segments of the spine should be observed, both on flexion, extension and rotation; also the flaccidity of any group or groups of muscles.

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If the patient is now made to lie down upon a perfectly flat surface and his trunk and extremities straightened as accurately as possible, any shortening of either extremity or other anatomic deviation is most easily seen. The motility of the joints and soft parts of the lower extremities should be investigated; contraction of the hamstring muscles (Kernig's Sign) noted if present; adduction and abduction of the extremities measured; relaxation of the ligamentous and muscular structure throughout the body noted.

The patient is now turned upon his face. Superficial sensation is tested, and here we are usually able to differentiate between strictly local and reflex conditions, as when a pain symptom is produced by reflex disease superficial palpation elicits greater pain than deep, whereas if the tenderness is markedly increased by deep pressure, the condition is almost certainly local. At this time too it is always well to test the skin of the trunk and thighs for anaesthetic areas as well as for reaction to heat variation. Also the presence or absence of the normal reflexes should be ascertained.

Having carefully made our investigation thus far, it is insufficient that the examination terminate here. If the patient is a man, the anus, rectum, prostate and membranous uretha should be carefully examined. In the female, in addition, the pelvic genital structures. Where the catheterized specimen of urine shows albumen, pus cells or epithelium, the patient should be cystoscoped and the ureters catheterized.

X-RAY INVESTIGATION

The patient, regardless of any other contributing cause which may have been discovered, should now be X-rayed, and this X-ray investigation should include the pelvis, lumbar spine and lower dorsal spine. Stereoscopic plates, as well as antero-lateral and transverse views should be made, and it is well to recognize the fact that almost as many errors have been made by misreading the shadows which are prone to pile up and magnify themselves in this region, as correct diagnoses, through the use of this most wonderful addition to our diagnostic armamentarium.

EVALUATION OF SYMPTOMS AND FINDINGS IN EXAMINATION

Assuming that a careful history has been taken and that a complete physical examination, together with the special examinations necessary, has been made, it is important that the symptoms and physical finds be properly evaluated. Mechanical injuries involving the bones, soft parts, or both, produce symptoms depending more upon the degree of muscular spasm excited than the amount of destruction present (that is if we exclude destructive injuries involving the spinal cord or nerve trunks), and this muscular spasm is quite apt to be more pronounced in the minor injuries, such as the incomplete fractures and luxations, than it is with the more serious injuries. In fact I think you will all agree with me that it is not uncommon to see patients with gross destruction of bone and soft parts, such as fractures of the bodies of the vertebrae and even partial luxation, who give no marked symptoms of any kind. I have

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seen many fractures and a few fractures with partial dislocation of a vertebra, which were unrecognized by the patient for long periods following the original accident and the presence of which were only recognized following a lesser injury or a routine examination because of pain incidence due to some other cause.

It is important that the true anatomic changes which have existed for a long period be not confused with recent traumatic conditions; that such changes, the result of occupation—as for example the lordoses with posterior narrowing of the lumbar segments so commonly seen in miners and persons of similar occupation—be not mistaken for compression fractures; that slight luxations, either of the lateral lumbo sacral or the sacroiliac joints—which are not readily recognized on examination nor shown commonly even in the most carefully and efficiently made X-ray plates, be not overlooked, as they undoubtedly do give most acute and distressing symptoms and may become the basis for a more or less well defined permament invalidism unless properly treated. A differentiation between these two injuries which give almost exactly similar symptoms is most important, and here it has been found that where the injury involves the lateral lumbo-sacral articulations, Kernig's Sign (or contraction of the hamstring tendons when the leg is extended upon a flexed thigh) is absent, whereas in sacroiliac diseases or injuries it is invariably present.

Another condition most commonly wrongly interpreted is the hypertrophic arthritis so frequently seen involving the lumbar segments and going unrecognized until a major or minor trauma calls attention to a previously existing discomfort in the back, probably by exaggerating it and making the pain symptom more insistent. As a rule, I believe that this is due to the fracture of one of the hypertrophic nodules and the coincidental pressure of the detached portion upon one of the lateral spinal nerves, or possibly a muscle spasm due to the localized irritation.

The same proposition holds true in regard to certain other bone conditions, as malignant metastases, syphilitic, tuberculous and other infections, old and recent, and also not infrequently calls the attention of the physician and patient to a previous injury, the symptoms of which have never been sufficiently acute to disable the individual, but in which a slight added injury increases the discomfort, and this, together with the previous annoyance which has been borne without complaint, induces a true disability.

The presence of a congenital malformation of one of the lumbar segments, especially common in the fifth lumbar, which has existed without symptoms for the whole life of the patient, but which, following an injury, does produce symptoms probably from two causes—first there is a moderate degree of alteration in previous bony relationship, and this occurring—as is usually the case, in persons of middle life when the ability of the tissues to accommodate themselves readily to changes of conformation has ceased to exist, excites inflammatory reactions which are painful. In the second place, if any individual's attention is called to an existing defect or deformity in the presence of a pain association, a suggestion neurosis is most easily established. Fatigue, either the re-

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sult of excessive use or abuse of normal tissue or associated with a debilitating disease, such as hyperthyroidism or the low grade infections. In which the real cause of the disability is completely overshadowed by the local condition is most readily mistaken for local or other remote pathology.

TREATMENT

Just a few words in closing regarding the treatment of some of these conditions. Naturally the treatment of the symptom is merely a matter of the treatment of the disease. It would be well however for all of us to impress upon our minds the fact that very many disabling diseases and injuries are the result of vocational conditions and that prophylaxis is as important here as in other preventable pathologic conditions. Take for example the employment of the man no longer young, who has for many years followed an occupation which necessitated the special functioning of a certain group of joints and their associated soft parts. These have naturally become habituated to the trauma incidental to this particular occupation. If, however, this same individual is forced to change to some other variety of work in which a totally different group of tissues is used, there follows a very severe reaction to this strain, and because of the inability of these structures to conform to their new function or increased use, there follows a train of symptoms out of all proportion, apparently, to its cause.

PREVENTION

If the employment agencies of the larger corporations selected more carefully the individual suited to the work, and if at various periods following his original employment he were examined with the idea in mind of continuing his usefulness as long as possible, much could be accomplished in the way of prevention, not alone in this particular type of disease under discussion, but in many other conditions which may be termed occupational. I have always felt that if, in some ways, men were considered as machines rather than as humans, a real advance might be made. If men were rated as having a certain standard of physical efficiency, and re-rated following any illness or injury and at different periods in their lives, and if with each rating a certain variety of occupation or certain definite amount of work were prescribed, much could be done to increase the total available labor efficiency. Most certainly there would be many difficulties associated with an attempt to carry into effect a system of this kind in any but the largest industrial organizations, where men are employed for a long period of years and where old age and disability pensions are part of the industrial program.

The treatment of the minor fractures, that is fractures of the transverse processes, spines or lamina (not causing cord involvements) and the associated injuries to the soft tissues is, in my experience, usually badly done. If the patient falls into the hands of a physician sufficiently careful to recognize the extent of the injury, he is quite apt to have the gravity of the condition exaggerated and his treatment directed along lines which cause an unnecessarily long period of disability, with not infrequently a more or less permanently established neurosis. A moderate

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period of rest in bed, ten days or two weeks, followed by massage and gentle active motion is infinitely more satisfactory than longer periods of rest associated with fixation by plaster casts or other appliances designed for this purpose.

In the incomplete luxations, such as those involving the lumbo sacral or sacroiliac joints, if a diagnosis can be made immediately, quite a definite proportion of them would be decidedly benefited by an immediate attempt at reduction. It is something of a question whether or not patients who, following an injury, show a marked contracture of the erector spinæ muscle and the other characteristics of this condition, should be given a general anaesthetic to the point of complete relaxation, and an immediate reduction of the luxation be effected. The only objection to this procedure is that in a certain number of cases the luxation has reduced itself and the symptoms remain for a period.

With the major injuries there is no question but that a period of fixation should follow the primary treatment, and that following this period of fixation, which should be long enough to give the parts ample time in which to have completely healed, and where the bone is involved, for calcification, following with a second and much longer period, with passive motion, massage, and later-active motion, should be allowed for the return to normal of the injured structures before any attempt is made by the individual to take up his usual occupation.

You will understand and appreciate that this discussion is the merest outline of a very large subject.

DISCUSSION OF DR. BRADFORD'S PAPER

Dr. Robert Osgood, Harvard Medical School, Boston

I wonder if I may be allowed to say just a word in relation to Dr. Sayers' paper before I come into this discussion. The subject is one that I have been tremendously interested in—particularly in connection with the army work.

In the army we were able to limit the number of splints necessary for the treatment of all bone and joint casualties and still handle them satisfactorily. The French were using about 300 different kinds of splints, the British were using about 45 or 50, and we finally got down our splints to 17, which were the standard splints of the American army. Industrial surgeons might well employ the splints which were worked out in the army for first-aid.

I am not quite sure what Dr. Bradford means by idiopathic luxation. If he means these slight slips which are said to occur by our osteopathic friends, I have tried very, very hard to check that up by X-rays, but up to the present time I haven't been able to make a clear-cut diagnosis of such a lesion. One of course recognizes certain numbers of true luxations, but I think we want to be a little careful before we admit the slight luxations without having any definite proof in the X-ray that they occur.

I also quite agree as to the importance of looking out for ligamentous diseases. They are very frequently occurring and the element of pain is the dominating factor.

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Cases of hypertrophic arthritis are very common. We have also the so-called Strumpel-Marie type and the infectious type.

I differ some with him when he says that these hypertrophic cases often make a good deal out of their spines. I am sure they may in certain cases, but any hypertrophic joint, whether it is a finger or a knee or a spine with a hypertrophic condition, may be expected to light up and become an extraordinarily acute joint after injury.

The keynote of infectious injuries is moving up to the point of toleration. The keynote of hypertrophic injuries rests, because hypertrophic arthritis almost never goes on to ankylosis.

You may find an occasional fusion if you examine the specimen of hypertrophic arthritis; you will find that almost never do you see a bony ankylosis in this type; you find overgrowth, you find interdigitation, but you don't find solid bones.

DISCUSSION

Dr. Clark: In the Norton Company during the last two or three years I have never seen a true back strain which has incapacitated a man for any considerable period.

When these back cases occur, they have almost invariably been able to demonstrate an arthritis of the spine, so that we have felt, unless a man comes in with a history of lifting something far above the ordinary weight, taking perhaps hold of a heavy bar of steel with another man and the other man letting his end go, the chances were very strongly in favor of the pain being felt because of the symptoms of which the man complained.

Now we have a very large number of accidents—these apparently minor injuries resulting in long periods of disability—and we have made it a general rule to consider these cases in this way: The first thing we do is to look at the man's feet, when he comes in complaining of back strain. We always make that a routine practice, and we examine the feet very carefully to see whether there is any hysteric condition there which has been throwing the sprain or his back in abnormal posture. We always fix up anything that is at all suspicious about the feet first, and then we go on to examine the spine.

The thing that I am particularly interested in, is this question of sacro-iliac injury—whether it really occurs, or whether it doesn't occur. I have always felt that it was a very questionable condition, judging from the literature I have read and from the things that I have heard from my practical experience. I have seen cases which I was at a loss to diagnose any other way than as a sacro-iliac sprain.

MANIPULATION

I would like to ask Dr. Bradford and Dr. Osgood about manipulation, which I have done myself, but I heard only last Saturday that a very prominent industrial surgeon told a group of similar men that the method of relieving this pain is a series of sacro-iliac strains or sprains by manipulation. His manipulation consisted of putting a patient under a general anæsthetic on the face, making traction upon the leg on that side, and

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gradually increasing the traction until he had a pretty strong traction and then making hyperextension of the leg. He said that a man was hobbling around before he got on the table and following the anæsthetic, he was able to get up and walk around without any pain at all, without the need of any support.

A case which I remember very distinctly was that of a man in the army who had received one of these diagnoses of double sacro-iliac in France. This man was completely incapacitated. We were at Camp Taylor, and an orthopedic specialist made an effort to reduce that sacro-iliac by hypoflex, that is, flexing the extended leg and thigh on the abdomen, with the patient asleep under anæsthesia. He continued this sawing motion until something snapped in the region of the ribs. He said that if you got that snap and pulled the patient up in plaster, that did very well.

I am waiting for further eludication on that. If this business is an extremely important thing in industrial medicine, we ought to clear it up. I suppose that cases of this kind give us more trouble than anything else.

Just to finish up, I will describe one back case which is rather interesting and shows how easy it is to make a mistake. A man came into the hospital giving the history of having lifted some very light tanks with another man and having strained his back three days before. We found that he had a little rigidity in the spine, so we strapped him up. After three days he didn't seem to be better, so we sent him to the Memorial Hospital for further X-rays and a plaster cast. When he got to the hospital they made a complete examination of him and found that he had some sugar in his shoulder. They therefore transferred him over to the medical hospital for further examination. Here they put him through all the usual tests and found that he was a complete diabetic, and that he was in a very dangerous condition because of his diabetes. They tried to treat him for diabetes, but a diligent house officer in making the examination noticed that there was a little matter on one side, but still a mass, and he called the attention of the visiting man to it. About five physicians examined that mass and four different diagnoses were made, but the mass increased in size, whereupon we began to get suspicious that there was undoubtedly an abscess. We made a diagnosis and found that one side was probably longer than it should have been. The patient refused to take an operation and left the hospital. However, he went to another hospital after four or five days, and an operation was performed there. In that operation a lot of pus was removed from the region of the left kidney.

Now, the interesting part about this is that that man's back symptoms led us on a false trail all the time. This simply backs up what Dr. Bradford said about looking out for the side every time.

Dr. F. E. Schubmehl (General Electric Company, West Lynn, Mass.): I think Dr. Clark's statement with regard to the trouble that we are having in industries where there is a great deal of lifting, is certainly a problem. The back trouble that we find prevalent needs more attention than we have been able to give it in the past.

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Dr. Clark spoke about a physician who did something to these backs that immediately relieved the pain. I heard a speaker not long ago who had gone through the same experience himself. I had no reason for doubting the sincerity of his entire remarks. I know that Dr. Clark and the rest of us have a feeling in the matter, but he was absolutely telling what his experience had been. We have not been so fortunate. We have tried various methods of relieving these conditions, and of course many of them get better, but subsequent to that time they suffer greatly from back trouble.

We have sent our cases around to various hospitals for relief. Some show nothing in the X-ray, and although others are benefited, we don't get any results from treatment.

RELAXATION

Dr. Schram: It is true that the back cases are the bane of our life, and one point was brought out at the National Conference Board of Physicians the other day that I have found to be the best treatment for them. That was complete relaxation. Irrespective of manipulation, irrespective of strapping, irrespective of plaster bandages, if you can get the patient to lie relaxed, you will find that it is the best treatment.

In the average lame back that comes on in our industry, I feel that if you can get the patient to relax, you have done the major part of your treatment. In the obscure cases where there is some deformity of bone, you may have further trouble and have to go farther for treatment.

Dr. Bradford: I am going to run over just a few of the questions that were asked. Idiopathic luxation—of course, there is no such thing as idiopathic luxation, but what we usually mean by an idiopathic condition is a condition for which we do not know the exact cure. It is not an immediate trauma; it is not, in many of these cases, a general relaxation or a developmental process, or a debilitation of age or disease. There is some other element in it or associated with it.

If one discovers, or thinks he discovers, a new disease and condition, and investigates, he will find that is a most common condition. There is rarely in medicine a condition that is extremely uncommon. I remember that at one time I had a series of malignant disease cases which got well with inadequate operations. As a matter of fact, it was a question whether the operation did good or did harm. I found that there was a series of eighty-five that had gotten well following no operation or an inadequate operation.

As to atrophic arthritis in other joints, it is a continuation of the hypertrophic condition in all probability. This is, perhaps, a rather lax way of speaking of it. As a matter of fact, when we speak of lame backs, we speak rather laxly. There is a lot of unexplored territory associated with it. We have just commenced to investigate this subject more thoroughly than we have done in the past.

Speaking of the pain in hypertrophic arthritis, I believe that where a condition is an atomic or pathological change of any kind, the pain comes on slowly. It is a moderate discomfort and not very acutely painful, and does not make an individual complain very much. Of course, if

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he has his attention called to the pain, he will feel it. Suggestion has a great deal to do with the increase of the symptoms.

I think that in these conditions of the spine we probably have not used sufficient control, that is, we recognize one of these conditions giving definite symptoms, but we don't control our observation of that particular case by the observation of a dozen other similar cases which do not give symptoms which disable the individual—and that is really about the only mark that we have.

The bony ankyloses, of course, do not occur in hypertrophic conditions of this specific type. I have written just a little in regard to the treatment of these conditions, but I am not going to say anything about it because the time is limited.

The replacement of luxated vertebrae is possible in cases of immediate luxation; in old luxations which have existed as luxations, it is relatively impossible. That is my experience, and it is not a large experience, with luxated vertebrae, or luxated fifth lumbar vertebra.

This particular luxated vertebra was reduced with relative ease. The symptoms came on acutely, and in such a case I think what Dr. Clark has said about complete relaxation is important. The complete relaxation in the treatment of any acute lumbar spine or associated anatomic area condition—if these patients are given a large dose of morphine, either locally or otherwise (I have sometimes thought that local injections possibly overcame the spasm of the muscle, and I think that part of this discomfort is voluntary muscular spasm, that is, an involuntary spasm of a voluntary muscle)—is accomplished easily.

Now this patient's luxations were reduced by increasing the deformity, by bending him very sharply backwards, just as one reduces a Colles fracture. I don't know how well it would do in other cases. It was successful with this particular patient. He has this happen to him occasionally.

In regard to sacro-iliac, of course there is such a thing, not very common to be sure. It is very unusual, but undoubtedly there is such a condition.

Just a word in regard to manipulation. I believe that we do not adequately recognize the importance of manipulation in certain painful conditions of the joint. My experience seems to indicate to me that there is a condition rather late in the development of a painful joint where an active manipulation is truly beneficial and practically immediately curable. One will be astonished at the apparent good which he does for his patients by manipulation in properly selected cases. Now, I don't mean that one should manipulate an acute inflammatory process. I do believe that we treat acute inflammatory processes rather badly. I believe that we treat most of the spinal conditions very badly.

I think the enthusiasts in investigating a condition which is not new, but something unobserved, or insufficiently observed, are not infrequently over-enthusiastic, and do not see the woods before the trees; they see only one phase of the subject and draw a conclusion from an incomplete observation.

Just a word more about the relaxation which Dr. Clark spoke of. I

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have during my medical life heard much of lumbago, but just exactly what lumbago is, I am not at all certain in my own mind. Apparently it has somewhat the character of a torticollis; it is a painful spasm of a group of muscles. If this relaxation can be secured in that condition, the relief is so immediate and continuous that it is a very definite thing. In the old days of needling conditions of this kind (I doubt if all of them were pure suggestions), I have a feeling that there were cures effected by these imperfect methods, which we should not too lightly throw aside.

It is very difficult to select the wheat from the chaff in this stuff. I know that the more I see of these conditions (and I am seeing more of them now because of the compensation laws in the various states; before that people went about their work, or failed to work without very much investigation), the better I realize that this is true.

Dr. Osgood: I believe that actual luxation of the sacro-iliac joint is comparatively rare, but it does really occur at times. I don't see how we can otherwise explain the case of a man who came in with a marked deviation of the spine and was advised to go to a hospital for manipulation. He was rather poor and he would have had to walk some distance to get to the hospital, so I put him in one of the steel frames we employ for the application of a plaster jacket. There were two narrow steel bars, and as he sagged back on the frame, he suddenly said, "My pain is all gone. I wonder if these fellows will let me sleep on this tonight." It was sudden and unexpected, but relief was definite.

I think that what Dr. Schram has said about relaxation is of extreme importance. I believe that is what the osteopaths do. They succeed in relaxing muscle spasm by manipulation. I think our own plaster casts do the same thing, in that they diminish muscle spasm and the patients reduce themselves.

TEACHING HEALTH IN SCHOOLS

A volunteer paper on "Teaching Health" was read by Miss Briggs, Superintendent of Schools of Newton, Mass. She described the work of the Child Health Organization of America under the leadership of Dr. L. Emmet Holt of New York. A strong contrast was drawn between the modern idea of health teaching with its games, sports, fairly tales, clowns, parades and a few simple attractive health rules; and the old grind method of teaching physiology and anatomy, with here and there a little hygiene. The men and women of tomorow must be stronger, healthier, more efficient and longer lived than those of today. The one greatest factor in bringing this about is that of using the 8 or 9 years of school life for health teaching.

BABY CLINICS

Doctor Amelia A. Dranga of Pittsburgh read a paper on "The Baby Clinic," in which the main points were as follows:

The Pittsburgh and Allegheny Milk and Ice Association was organized in 1899 "to reduce the infant mortality of Pittsburgh and to increase the

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health and vitality of surviving children. It is not the babies born, but the babies saved that count." It aims to educate each mother that comes to it in caring for herself and baby, and provides milk and ice where needed. The work is done by Doctor Dranga and two secretaries, one working in the field. Clinics are held twice weekly, with more than eighty mothers attending each.

Baby feeding is 25 per cent of the work. Care of nails, clothing, sleep, bathing, ventilation, mother care, general care, general care of home, and the whole baby environment make up the rest. The work of the clinic is followed up in the home. The field secretary makes regular visits and sees that instructions are carried out and that home conditions are made the best possible for baby and mother.

BREAST FEEDING

Dr. Dranga summarized methods of baby feeding as follows: Nurse baby at 7, 10, 1, 4, 7, and 10 o'clock, but not at night. Baby sleeps in its own crib in a room apart from mother. Crying does no harm—only strengthens lungs. Mother must have good food and rest, especially at night. A baby properly fed and cared for will sleep from 9 at night to 7 in the morning.

MIXED FEEDING

If mother has only part enough breast milk, use it, alternating breasts. Nurse 5 to 10 minutes, then give baby a bottle of modified milk.

MODIFIED MILK FEEDING

Start a three months old baby on top milk (top ⅔) 15 oz. boiled water, 20 oz., cane sugar, 2 tablespoons. This gives seven feedings of 5 oz. each daily at three hour intervals. We teach an accurate routine for keeping bottles, nipples and milk absolutely clean and insist on its strict observance. Vary strength of mixture to suit age and condition. Mellin's food may be used. Mothers must wash hands before preparing baby's food and after changing baby. Babies are weighed weeky. If they don't gain properly, something is wrong. Certified milk is always used.

Begin to feed orange juice, white of egg and oat meal at nine months, following with buttered crust, graham cracker, baked potato, scraped meat, and mashed carrot or spinach—always a small amount at first. Continue the milk feeding to two years.

A FEW DON'TS

Don't pick baby up every time it cries. Don't let it sleep with you. Don't feed it with the breast or bottle or anything else to quiet its cries; wait till feeding time. Don't put your fingers nor a pacifier nor an empty bottle nor anything but a clean nipple into baby's mouth. Don't give anything between feeding-times but a drink of water. Don't give baby bread, tea, coffee, bologna, cheese, ice cream, peanuts, pork chops, cakes nor candy. (These have been favorites among the mothers of our clients.)

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Don't dress baby in swaddling clothes nor in long dresses. Put on the 20 inch dress from the start with warm stockings and no shoes and let the baby kick.

For year ending April 1, this year, 463 families were cared for and 12 babies died, ten of them of pneumonia and only two of disease of the alimentary canal. The annual infant death rate for Pittsburgh is 110 per thousand.

This baby clinic is not only saving hundreds of babies, and giving them a chance to grow up into strong men and women, but it is educating the young mothers in each neighborhood in ways of right, clean, living. The women we teach tell their neighbors the good news of good-natured healthy babies and they tell others. We cannot know where the effects of work like this will end.

The methods used in the clinic may be modified to suit any industrial community large or small, and will bring rich returns out of all proportion to the expense and energy required.

RECOMMENDATION FOR FUTURE CONDUCT OF HEALTH SERVICE SECTION

For the sake of brevity, omission has been made in these Proceedings of the discussion which took place in regard to the manner in which the section should conduct its programs to the best advantage in reaching the industrial executives, superintendents, safety engineers, and others interested in health and sanitation in industrial plants. It was the consensus of opinion among the physicians and surgeons present that by conducting segregated medical sessions they would not succeed in securing a satisfactory attendance of laymen representing influential companies which are members of the Council. A committee consisting of Drs. Ford, McKinstry, and Elliott was appointed by the chairman to draft a resolution containing the recommendations of the section to be presented to the Executive Committee of the National Safety Council. This committee prepared the following resolution which was unanimously adopted:

Whereas, It is evident that the public health and medical program presented by the Health Service Section of the National Safety Council are not serving the fullest measure of their purpose in reaching those members most influential in the dissemination of public health and medical information to industry, and

Whereas, It is the feeling of the members of the Section that more effective results will be obtained if the public health and medical programs are presented to the general and special sections of the Council, therefore

Be It Resolved, That this Section authorize its officers to present to the Executive Committee of the National Safety Council this communication as the recommendation of the Section for the Board's immediate action.

ADJOURNMENT.

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Local Council Officers

ROUND TABLE MEETINGS

September 27, 28, 1921

C. W. PRICE, Chairman
General Manager, National Safety Council, Chicago

TUESDAY AFTERNOON SESSION

CHAIRMAN PRICE: This is an A. B. C. session. Every year, just as we have an A. B. C. session in the fundamentals of organizing a plant, we have an A. B. C. session on organizing a local council.

Now, keeping in mind the primary purpose of this meeting, I am going to ask first what gentlemen are here who are interested in organizing a local council in their own vicinity?

MR. S. M. LIPPINCOTT (Manufacturers' Association, Erie, Pa.): We are; our town is Erie, Pa.

In answer to Chairman Price's questions Mr. Lippincott explained that Erie is a city of 120,000 population; that it had had a local council without a paid manager; that this organization had functioned successfully for three years, but had been dormant for the past two years, and it was now the desire of the Manufacturers' Association of Erie to organize it on a new basis, Mr. Lippincott declaring he could give half his time or more to the safety council if necessary.

CHAIRMAN PRICE: Are you giving half your time, Mr. Hill? Mr. Hill is from Bridgeport, and he is the secretary of the Manufacturers' Association there.

MR. F. C. HILL (Manufacturers' Association, Bridgeport, Conn.): Not at the present time, but I probably will in the near future.

CHAIRMAN PRICE: I think we can discuss Bridgeport and Erie along very much the same fundamental lines.

SUCCESS OF LOCAL COUNCIL AFFILIATIONS WITH BUSINESS ORGANIZATIONS

In the first place, let me say that we have had rather a fortunate experience on the whole in making our local councils a section or division of an organization such as the chamber of commerce or manufacturers' association. We find that in this way you bring in a new group who are

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interested in safety that possibly haven't been active in your manufacturers' association or your chamber of commerce before.

Let us say you organize a local council and just to satisfy the board of directors of your organization you place on your executive committee one, or at the most two, representatives of that association. Then we find that the local council functions almost as an autonomous organization, with practically no interference from the association at all, and no desire to interfere, because they are doing a special piece of work, and it works out very nicely.

Then, there is one great advantage of organizing a local council as a part of the association in that you get right at the start the backing of influential business men.

THE BEST TYPE OF LOCAL COUNCIL PRESIDENT

Nowadays when we talk about organizing a local council, we always say that we must include in our program both public and industrial safety. It goes without saying that the next most important step is some one to head your organization, and let me say from the experience we have had in our local councils, that the ideal type of president is not the man with the biggest reputation, but is the man of a type of a young manager of an industry that is important, a young man who is recognized as one of the live, active young men, and who in his own industry is interested in safety. You there have a man who has something at stake himself. He is ambitious, he will give of his time, and you don't need to ask him to give much time, but he will attend your meetings and he will be a real presiding officer and an inspiration and a leader.

Some go after a man just for his name. I think it is a mistake absolutely. I think you want to get a man of influence, but you want to get a man who really is interested in safety and who will give some time to it.

We have found in many of the cities that you can build up your executive committee with two or three (and I have seen them put on five) vice-presidents, all of the type of your president or a little lower down the line, but who are not men whom you can make chairmen of committees, although they will be willing to attend your executive committee meetings and lend their names. I don't mean just taking them for their names; I mean men who will give more or less time and who are willing to attend meetings and willing to lend their influence.

THE EXECUTIVE COMMITTEE AND SUB-COMMITTEES

Your executive committee is made up of your presidents, your vice-presidents, and, the chairmen of your various committees. Let us say that you do put on three or five vice-presidents of that kind. Sometimes you will be surprised at what you will get out of some of them.

In reference to committees, you can have many or few, but I believe in having as few as possible, and having every committee a working committee. This building an organization that looks well on blueprint doesn't go, you know. You will want a finance committee. You will want a program committee—that is as good a name as you can give it. You will

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want a membership committee, a publicity committee and a public safety committee. Those are the indispensable committees. For chairman of those committees, you want men who are of the type of good safety engineers, or superintendents of plants, men who are right in the harness and willing to give time. When you go above that in rank, like a general manager—sometimes a young general manager will do, but usually not—he won't give the time and it devolves on somebody else. I think one ought to start right out making the chairmen of committees the type of men that are so much interested that they will give the time.

Let us say, then, that you have your organization, and you have work enough for each of the committees to do. As to the activities of your local council, I would say that on the industrial side, first, you want to conduct a foremen's school, not foremen's meetings but a foremen's school of ten lessons. Use the printed lessons, if you want to, of the National Safety Council. Make the school in every sense not an entertainment, but have the men going there feel that it is a school. They aren't going there to see moving pictures, they are going to attend the school, they are going to take the ten lessons, they are going to get their diplomas.

We have tried that out for three years. It is by far the most successful and effective thing we have ever done. Nothing we ever did in the local council compared to the service of a real foremen's school. I want to emphasize that you must have the school idea, the school front. When a man goes there, he knows he is going to school! he isn't going to a meeting or a dinner; he isn't going because there is a moving picture at the end, although you may have that. He is going there just as a man does who seriously goes to a class for mechanical engineers or anything else.

Mr. Lippincott: Would it be advisable to try anything like that in the first year? Why not get started with good speakers and get them interested the first year, and then the second year branch out into something like this?

THE ORGANIZATION OF FOREMEN'S SCHOOLS

Chairman Price: I am glad you asked that question, because that brings me right to the very heart of the whole business. We tried out for a number of years what we call foremen's meetings, and all that sort of thing, but there was something sort of "hit or miss" about it, not thoroughgoing, but when we organized the school and when we put up this sort of a front to the manager and said, "Now, look here, we are going to have a school for foremen, ten lessons, each lesson covering some vital point that a foreman must know to properly organize his department and conduct safety", it was quite another thing. Each lesson covers some vital point that a foreman must know to properly organize his department and conduct safety. The lessons will be given to the men in printed form so that at the end of the term they have the complete set in their file, each lesson presented by a man who speaks from experience, and can not only give them the information, first-hand experience, but because he is a man of that type and because he has had experience, he can convince them.

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Present to the manager the idea that this is not a "hit or miss" meeting business—good as meetings are—it is a series of ten lessons, ten evenings in ten weeks, that when your foreman covers those ten lessons he is absolutely equipped with all of the essential information that he needs to conduct safety properly in his department, and he is convinced. In other words, we are offering something that is thoroughgoing and complete.

It has been most surprising and gratifying to see how attractive the school idea is to a foreman. Now, you won't get the fellow that has no ambition, but you will get the foreman that has ambition. You will be surprised at how attractive the idea is to him that he is now for the first time going to take a complete course, as he will say, that will give him all that he needs. He will have the complete lessons in printed form and at the end he will get an engraved diploma that he can hang up in his office saying that he completed the course.

I say it is very attractive to the manager and it is attractive to an ambitious foreman because it promises something that is really substantial and complete.

We appeal to the manager first with a letter outlining in substance what I have said about this school. We start with him. We try to sell him the school idea. He then gets his superintendent, and between them they try to induce the more ambitious of their foremen to attend.

I am giving you all the fine points because every one of them is important. There is a psychology in this thing, and it is very simple. The presentation of that engraved certificate that the foreman can frame and put in his office, that he can show to his manager, is a little thing, but it is a touch and it has its place.

Then they always have a graduation banquet, and we have some of the influential men that these men would recognize there. You have a good speaker, just as you do at the graduating exercises of a high school or college. You give a dignity to it, and in that meeting you put across a message.

PRACTICAL MEN FOR SPEAKERS AT FOREMEN'S SCHOOL

I would say that one of the most important factors in the success of the course is, first, that every one of the men who presents those lessons is a man who can speak from experience. They do not need necessarily to be orators, they want to be men who can talk as man to man. It isn't a place for oratory; it is hammers and brass-tack talk. You want a plain, ordinary man that they can understand, but a man who can speak from a very wide experience.

If you have ten speakers, every one of them men of that type, that is the very backbone of your school and the secret of success. Without that, we are lost. For instance, one man might be selected because he was particularly strong on the mechanical side; you would give him the one on mechanical equipment. Here is another man who has done splendid work in workmen's committees, that is his hobby. It requires very careful working out to get the right men.

Another essential thing is to have a chairman of your school. In most

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of the schools, they call him teacher; a man who presides every night and who conducts the round table discussion, because about three-quarters of an hour is consumed in presenting the lessons and three-quarters of an hour in round table discussion.

You want to have a man who is a leader, whom the men will like, who knows how to put life into a meeting, knows how to draw questions out of the men, and whom they look upon as teacher. He must be a man who can put into this thing a school atmosphere rather than a meeting with a speaker. They must feel literally that they are going to school.

For instance, one of the things that is done is to have a class song, usually a safety song, and you would be surprised how grown men will stand up and sing that song. It is perfectly possible, absolutely. I would say that the right chairman is indispensable.

Another thing that has been done that is effective, that gives a little human touch, is when a foreman is absent from the school, the secretary or manager, or whatever he is called, drops him a card and says, "Sorry not to have seen you out at the meeting. We had a splendid speaker on First-Aid, and it was a successful meeting. The subject next time is Workmen's Committees, and we have Mr. So-and-so. I am sure that you will want to be present." It is just a little follow-up that shows you are interested in him personally. The more you can recognize each foreman not as a foreman of a plant but as an individual and a pupil in that school, the better.

USE OF RIDICULE IN PREVENTION OF ACCIDENTS

Mr. C. A. Cotton (Chamber of Commerce, Providence, R. I.): I would like to ask whether or not the use of ridicule in the prevention of accidents has its place, and whether it can be used advantageously.

Chairman Price: It has its place, but it has to be administered in small doses.

Mr. Cotton: Here is what we did in Providence: on either side of the Chamber of Commerce is a very much traveled thoroughfare up College Hill. It has been a favorite outdoor sport for everybody to go up that hill on high in their automobiles. We got up a story, an interview, calling attention to that. We showed that any sort of a machine could go up hill on high all right, but that the idea of showing off by going up hill on high and sending somebody else to "Kingdom Come" made it so absurd as to look actually childish. They were good enough to put the word "childish" in the headlines of the newspapers.

I know, playing golf the next Sunday, there were two fellows in the foursome I was in, and they got to talking over it. They didn't know I wrote that stuff, and they said it had never occurred to them before that way, and they were going to cut it out.

Mr. Hill: There is one point I wanted to bring out, in connection with that foremen's school. We appointed a committee on foremen's school to make an investigation as to the desirability at this particular time, owing to the industrial depression which in Bridgeport is very severe. We have not more than forty per cent employed at the present

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time. The manufacturers are very much down in the dumps, so to speak. They are not very strong on any new financial enterprises, and this committee reported back the inadvisability of starting a foremen's school at the present time, although not doubting the value of it when conditions become normal or approach normality.

CHAIRMAN PRICE: What per cent of the foremen probably are now employed? More than forty per cent, aren't there?

MR. HILL: Probably most of the foremen are employed on half time, but their salaries have been cut. The feeling is that the foremen would not dig down in their pockets and come out with anything for a school. The committee also felt that the manufacturers would not want to contribute anything at this particular time.

CHAIRMAN PRICE: We never charge a fee to the foremen. I believe it is wrong to ask it of a foreman. If he will give of his time in the evening to attend the school, he has done all that he ought to do. The employer ought to do the rest, and it is a mighty good investment.

MR. LIPPINCOTT: Right along that line, you know, even in giving a moving picture show in the plant, the men say, "These people just cut our wages. Why don't they give that money to us instead of putting it into moving picture shows?" They don't realize that perhaps the show is not costing the company anything, or it is only a small percentage. Right away they say that the plant is spending money on something when they have just cut our wages.

CHAIRMAN PRICE: This school is outside of an individual plant, and they couldn't criticize it in quite the same way. Here is a school conducted under your organization, and the opportunity is offered to them. I would say that a foreman, under present conditions, would have more time to give to a school. The expense of a school is not large, you know.

MR. HILL: Five hundred dollars, I was told.

CHAIRMAN PRICE: Yes, I would say five hundred dollars for Bridgeport, from what I know of the conditions. That will be largely spent on the railroad fare of some of your speakers. Don't try to save a hundred dollars by putting on poor speakers, because it will paralyze your school. The industrial situation is changing, and that enters into this thing; but we are discussing it fundamentally now.

TOO MUCH ENTERTAINMENT SPOILS THE SCHOOL

That brings me to one point that I expect some of you will differ with me on. Some of our councils have been so eager to have a bigger attendance, make it popular, that they have introduced entertainment features. I know of one where about half the program is entertainment. I think it is a mistake. I don't mean to say that you shouldn't have some entertainment, and you might have a moving picture at the end, but it must be incidental. In other words, going back to my first statement, it wants to be a school, it wants to attract men that are there for a serious purpose. They can go out to a show house and "beat you to death" on moving pictures; you can't compete with a moving picture theater. If you want to put a "movie" in at the end, that is good, but it must be

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incidental. The important thing to remember is that it is a school, it is a serious business. Their attitude of mind when they go there is not that of a man going out to have a good time. When he is there, he isn't there to be entertained; he is there to listen to a man who is speaking about something in which he is vitally interested, getting information that will equip him to go back and put safety into his department. You don't want the idle fellow, you don't want the fellow hunting a good time. He isn't any good to the school, it doesn't do him any good to come. I would rather have one hundred men in the school that are attracted by the thing as a serious school than I would three hundred that are going there to see a moving picture show. Yet I would say this, one of the interesting features of our school has been that nearly every one of them has adopted the plan of having a song or two at the outset—it seems to warm things up.

Mr. Wm. Schneider (Hays Manufacturing Company, Erie, Pa.): I really agree with you very thoroughly, but how can we explain this: when in our local safety council we were going good, had a real good speaker, possibly two, and had at the end a moving picture such as "The House That Jack Built", we got fifty, seventy-five, possibly a hundred people. Along will come the Pennsylvania Railroad, the New York Central Railroad, or any one of those large organization. They will rent a large auditorium, have one speaker and a stringed instrument number and a moving picture, and they will pull five hundred people.

Chairman Price: You can't compare them at all. Suppose you could get a hundred men to attend your school and take ten lessons. Suppose the other fellow can get five hundred men to attend that one meeting. Which will save the most human lives, the hundred men that go back equipped or the five hundred that come for that one meeting?

The interesting thing is that in these school, we have made a canvass enough to say almost with assurance that every foreman that attends that school and gets a diploma (that means he attends seventy-five per cent of the lessons) goes home and does something. We have never had such tangible results from anything that we have ever done, any service we have ever rendered through the local council.

Mr. Hill: Seventy-five per cent you say?

Chairman Price: Yes. Of course, if there is sickness, you are pretty lenient. You want to give every one a diploma if you can. If a man has sickness in his family, you may say to him, "If you will just read over that lesson, we will count you in."

Mr. G. E. Folk (Y. M. C. A., Lawrence, Mass.): It doesn't seem to me that these are parallel cases at all, the school and this large meeting that is held by the Pennsylvania Railroad. One is for intensive instruction, to prepare people to give education; and the other is simply a mass educational proposition for the time being, a rally.

Mr. Schneider: That wasn't my argument on that. What I was trying to bring out was: should you, and does it do any good to have an entertainment with the local safety meeting to create interest? When we had one we couldn't create any, but the New York Central or an outsider can come in and pull the whole city.

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BIG ENTERTAINMENT PROGRAM AT GRADUATION

CHAIRMAN PRICE: Suppose you say to your foremen that at the end of the course you are going to have a nice banquet, you are going to have an entertainment? That is only ten weeks off. If you want to have an entertainment apart from your lesson, have it. What I am trying to do is to get that entertainment feature outside of the school, so that you won't mix the drinks. I think it mars the school, they get so that they don't go there in the right mood. You must put a real school spirit into it.

MR. G. E. CLARKSON (Western Pennsylvania Division, National Safety Council): I would like to say, for the information of these gentlemen over here, in our school we had very little entertainment. About all that we did have was community singing. Then we go ahead with our subject, we present it in a straight-from-the-shoulder sort of a way, have our round table discussion, and at the end of the course, we hold out to these men a real entertainment, and we do give them a real night of entertainment.

CHAIRMAN PRICE: You make it an occasion, and you have the managers and presidents of the industries there.

MR. J. W. COSTLEY (National Enameling and Stamping Company, Granite City, Ill.): The school in our vicinity has in no way, shape or form conflicted with the activities of the council. We have our monthly meetings and they have never changed for five years past. We haven't allowed anything to cause us to deviate from that.

To get interest aroused in the plants, we have adopted this plan, and it has worked out very nicely this last year—we have a program. The point is to get the men there, and then convey to them the message by whomever we may have for a speaker. But, in order to create interest and rivalry in the plant, and get the plant management interested, too, last year we adopted the plan of putting it up to the plant to furnish the entertainment.

For example, the American Steel Foundry will furnish the entertainment one month. All the rest of the plants are going to be there to see what the American Steel did, because they know they are going to have to give the program for one of the other nights. The National Enameling will give the program next meeting time.

CHAIRMAN PRICE: How large a proportion of the program is the entertainment feature?

MR. COSTLEY: About thirty minutes. We give them about four numbers, that is, two before the speaking and two after the speaking.

CHAIRMAN PRICE: Do you always have a dinner?

MR. COSTLEY: No, sir. We have our annual banquet, which is the big affair of the season, and that is paid for by the management and attended by the management. They come and tell us what they think about what we have done. That is always held the first Monday night in May.

This entertainment is always taken out of the plants. They have fellows who can sing a song, can play a piano solo, can do all kinds of things. You will be surprised at the amount of talent you have in your

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plants and how glad they will be to show that they can do something that the rest perhaps didn't know they knew how to do.

CHAIRMAN PRICE: I think we have finished with the school, and we can properly pass to this other.

MR. COSTLEY: We have an executive committee. This executive committee meets on the second Wednesday afternoon in each month. We meet at the various plants, and we are dined at that plant. They set up the finest luncheons you ever sat down to, and they are all anxious to say, "We will take the executive committee next month." At that meeting we make a plant inspection. We have about twenty, and you can take twenty through a plant very nicely. All of our activities are carried through this executive committee, coming back to report anything of any special importance to the general meeting on the first Monday. We have carried that plan out for about three years.

CHAIRMAN PRICE: This school may be conducted as I have indicated, without in any way interfering with the carrying out of this monthly meeting. While they are both on safety, they are quite distinct, and you can keep them distinct. The monthly meeting is a little more on the popular order.

MR. LIPPINCOTT: If you haven't any one who has ever attended a school, what are you going to do for teachers? Do they have to be graduates of a safety school?

CHAIRMAN PRICE: Most of the speakers that we have are men who have done especially good work in their plants. You can import a good many of your speakers because you want the best, Frank Morris, Oartel—that class of men.

MR. LIPPINCOTT: Mr. Price, is this school that you speak of entirely devoted to the matter of safety?

CHAIRMAN PRICE: It includes first-aid, of course, but it is the educational side of safety largely.

SAFETY MOVIES TO REACH WORKMEN

Before we forget it, the other activities of a local council that are fundamental are these—whatever meetings aside from the school that you have for foremen, we have found that the moving picture is the only thing that is successful. There may be a little talk, but the safety moving picture film is the way to reach the workmen.

MR. LIPPINCOTT: Would you work that in the safety council meeting where the pictures are shown at the plants from time to time? We have our own machines there and show these pictures around at the various plants. Would it be advisable to show them at these meetings?

CHAIRMAN PRICE: Many of the secretaries have a machine, and some of the best work that has been done in Pittsburgh has been done in the plants. I know that there is always a greater demand than supply for it. Sometimes they can conduct a very successful meeting in the summer in the park, where you can get a large number of people and put up your screen ten feet from the ground.

I think your plant meetings would be the backbone of your effort for

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the workmen, but I was going to say that you might have in the summer some films on industrial safety and then a comedy. It is very easy to reach a large number of people.

The next thing that should be mentioned is this—we become so much interested in educating the foremen that we forget the general manager, and we are apt to educate our foreman away from our general manager, and the poor foreman is helpless, can't get anything done.

You want to commence to educate your manager right at the start. Suppose you have sent this letter to the managers about your school, suppose just after your school opens you can get a luncheon of the managers of industries and tell them what you are going to do. We have found that it is necessary to have three or four meetings of the managers during the year and if possible have speakers from the outside who can present the whole thing from the standpoint of efficiency.

Some of these things seem mere details, gentlemen, but they are not details; when you are dealing with anything that is as delicate as a human equation with foremen, you are dealing with something that has to be handled right, because a little mistake may have serious results.

Now, at your first managers' meeting, you could have somebody from the National Safety Council to sell the idea. Then, if you could have three or four of those meetings a year and could have such men as A. H. Young, for instance, of the International Harvester Company, who knows how to talk about this thing from the standpoint of industrial efficiency, it pays in dollars and cents.

My point in emphasizing the program as I have is that when you have that meeting of managers the first time, you have absolutely got this program lined up definitely. A hard-headed manager today is organized to death, and he doesn't want any generalities. He wants a very definite, constructive program that promises service to him. He wants none of this hurrah boy business, but something very definite and constructive, and that is why that school idea is so appealing.

ADJOURNMENT.

WEDNESDAY AFTERNOON SESSION

CHAIRMAN PRICE: If any of you have any questions to ask on the fundamental organization of a local council, and the industrial activities, discussed yesterday, we will be glad to have them.

MR. COTTON: Mr. Price, relative to our Providence situation, as you know we have formally organized a Providence Safety Council, as a part of the Chamber of Commerce and not as a part of the National Safety Council. What would be the steps in order to become a part of the National Body, and what help would we receive from such affiliation?

NATIONAL SAFETY COUNCIL AID TO LOCAL COUNCILS

CHAIRMAN PRICE: The procedure is simply to get ten Safety Council members to sign an application, saying that you have organized and would like to become a part of the National Safety Council.

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Now, the first thing you will get in the way of help, is assistance in getting organized. I mean to get the whole organization worked out, so that you might have the benefit of what other cities have learned. It is a long story. That would be one service.

Then, a second one is this: that your secretary or manager may attend the quarterly conference of the local managers, and there he is placed in touch with every detail of the experiences of all those twenty-two men, as this whole thing develops. For instance, I remember spending three hours one day discussing how to make a success of the foremen's school. We took up all of the things that entered into it. You can ask any question you want to. If you have found that some secretary has had phenomenal success, and you want to spend an evening with him, you can do that. That is the best thing we have done.

You are also privileged to ask any questions that you may wish to, of the general office. You get information from week to week on things that come in to us from the other local councils, and we are now publishing a circular letter with three or four mimeographed pages, giving the news in regard to the other councils. We are trying to keep you in touch with the experiences of the other councils.

For instance, I sent out some time ago, the plan of financing public safety, which has been developed recently in St. Louis, and is one of the most valuable contributions made, because it was one of our most difficult problems. That was a distinct advantage to everyone, because you got the benefit immediately of their experiences. We are planning this fall to pool our experiences, and to work out some more systematic way of helping the locals to get speakers, so that you won't be competing with Pittsburgh, say, but that you will all be given consideration. We have a certain number of speakers, and we will send them around and time them so that they could possibly each visit a dozen local councils. That is one of the most valuable services that we have.

Mr. Cotton: We have also a per capita financial obligation to the major body, do we not? We pay for our membership a certain quota?

Chairman Price: The local councils to date have not paid anything as local councils, but they are now working out a plan which will mean that you may make some slight contribution to the general propaganda.

Mr. Cotton: On the other hand, our members do not receive direct literature from the home office?

Chairman Price: The members of the National Safety Council will, but no others. It doesn't change your members in their relations to the National Safety Council. They are getting the same benefit as before, but in addition the local benefit.

ORGANIZATION OF PUBLIC SAFETY DIVISION OF LOCAL COUNCIL

Now, let us take up the subject of public safety. The public safety part of your local council is a committee of your council. It is a division, or we call it a public safety committee. It is subordinate to your executive committee, and you don't want it as anything else. You wouldn't want two organizations. You want a local council, and two divisions—the industrial and public, including in the latter the schools.

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The most important man in your organization, with regard to the success of it, next to your president, is the chairman of your public safety committee. Many times he is not an industrial man. He might be—but probably he is not. He might be a city official—but the chances are he won't be. Have some man who is vitally interested in public safety from a financial standpoint, if possible; some man who is public-spirited. I have in mind now Mr. Spoehrer, chairman of the public safety committee of St. Louis. He is in the light and power company of St. Louis, and they are interested in public safety.

Now, the important consideration in organizing that public safety committee is to place on it men and women who are representative of various organizations which can be of assistance to them.

Have people on the committee who are identified with, perhaps the Rotary Club, the churches, any business men's clubs, the superintendent of schools, the Boy Scouts—or any organization that is of such a character that it is interested in safety, and that it can lend influence and give you backing, and in many cases give you active co-operation. For instance, if you can get the Rotary Club to endorse you and give you one or two programs a year, with a speaker on safety, and the individual members of the Rotary Club are informed and they are as individuals in their various ways co-operating, you have done something with the Rotary Club.

So a representative man, a man who can go back and tell the story and get his club with you when needed, is a very valuable part of such a committee.

A second consideration in selecting your committee, would be to get citizens who may not represent an organization, but who have influence. For instance, we always put on city officials who are in a position to be of service. You might have one or more of your municipal judges, the chief of police, captain of the traffic squad, superintendent of schools, firemen, coroner, street commissioner, and so on. A representative of your federation of churches, and a representative of the Catholic church also make valuable committeemen.

So let us say you have a committee of fifty. You are then coming to a thing that is very important. St. Louis found that that committee was a little unwieldy to do the real detailed business, and so they adopted the plan (and I think it is one to be recommended) of having that committee of representative people meet once a month. They have an interesting program and sometimes have a hundred people present. They have some interesting subject discussed, and they also have reports from traffic officers and others on the program, and in that way they keep all the members of the committee interested and informed.

IMPORTANCE OF STEERING COMMITTEE

But as I say, they found that that wasn't a working committee. I mean that in the sense that they could not do business on the less important details. So they appointed out of that committee another committee of five or six, the little executive body, that really does the lining up and

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canvassing of the situation before a meeting, and then decides what shall be presented to the meeting.

For instance, one time before they adopted that plan, some one got up and said some very impolitic things that got into the newspapers, about the police. It wasn't the thing to do in an open meeting. It was simply bad policy from the standpoint of getting things done. A matter like that now goes to the small committee and they decide whether it shall go before the larger committee. In other words, that little committee is a steering committee.

Now, out of your larger committee, it goes without saying that you will appoint your subcommittees. For instance, you will have a committee on schools, of which the superintendent of schools will be the chairman. You might have one on churches, with two chairmen—the Catholic representative and the Protestant representative. You will also probably have a committee on police, of which probably the captain of the traffic squad will be the chairman. And so on down the line.

But I would appoint at first only such committees as I had very definite work for. There is nothing that kills an organization like a committee that hasn't anything to do. Appoint committees as you need them, and if that is done in a permanent organization I think it is a good thing.

Of course, when it comes to "no accident week," you have an easy problem, because you can give everybody something to do. It is too big a job for one man and you can give everybody a part in it and some definite thing to do.

Now, I don't know that we need to discuss the work of the various committees. We are all familiar with what a police committee would do, and a publicity committee and a school committee. I do not believe therefore that we need to stay long on that, but it ought to be emphasized that one-half of all that you are going to do will be done through introducing the right system of safety instruction in the schools. That applies especially to public safety. I say that one-half of all that can be done in any town on public safety (and I was also going to say industrial safety) will be done through the schools.

ORGANIZATION OF SCHOOLS FOR CHAUFFEURS

We might speak of the chauffeurs' school now. I remember that in St. Louis, we said, "Now who are the men on the street whom, if we could get them interested, would do the most to prevent accidents?" We decided it was the traffic policeman, first, and the drivers of trucks, second. We decided to form a school for drivers of trucks, and at once there were five hundred drivers—Mr. Lintz, how many chauffeurs did you have in your school at Cleveland?

Mr. A. H. Lintz (Cleveland Safety Council, Cleveland, Ohio): One thousand registration, and a graduation of eight hundred and fifty.

Chairman Price: Now we found that most of those who attended were drivers of trucks, and not ordinary chauffeurs of automobiles, although anyone was welcome. But we were primarily interested in the man driving a heavy truck, because it is hard to control, and the man is driving on the streets all the time.

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We got the thing started by reaching the owners of trucks and offering them this series of twelve lessons. We have them printed, by the way. They have been worked out in a systematic way. We spent nine months working them out.

The lessons have two divisions—one on safe driving and the other on mechanical safety of the machine. We have one lesson on the brake. These lessons represent the last word on the subject, are very inexpensive and contain all the information you would need.

We recommend that each student be furnished with a set of those lessons, and that the school be conducted the same as the foremen's school—that you have a permanent chairman; also that each lesson be presented by two men, perferably, one on the mechanical side and the other on the safe driving side.

It was found that the traffic policemen brought in there proved to be most valuable men to put across the message on the safe practice side, and get those drivers really to take an attitude of respect toward a traffic officer and get his point of view; to quit talking about him being a nuisance, and to recognize him as a servant of the people, trying to do his duty to keep people from being killed, and that the driver was as much morally obligated to make the streets safe as the traffic policeman.

One of the valuable results of the school was to send the men out with another attitude—entirely changed.

One of the important features of public safety work is to organize a chauffeurs' school in any town where you have men who are competent to teach. You can take them out of garages and out of automobile sales offices—men who can speak on some particular thing with authority, and answer questions. And with the help of these lessons that can be placed in the hands of your teachers you can get across to those drivers your message.

A chauffeurs' school is a very easy thing to organize if you get next to the men who have trucks—your manufacturers, wholesalers, trucking companies, dry goods stores. Have them send their drivers, and if you succeed in doing that you are reaching the keymen who can do a great deal to make the streets safe.

COURSE FOR WOMEN AUTO DRIVERS

Another thing they have done in Minneapolis and other cities, is to organize a lady drivers' club, made up of women who drive automobiles. They never have more than six lessons, and a most interesting thing that was done in Minneapolis was that at the close they had a little tournament or contest in driving out on the fair grounds. They put barrels around, and let the ladies drive around them, and back in again. They had certain stunts, and offered prizes.

Another thing that they did at the close, was to take the armory, and each sales agent had his automobile there and somebody to explain it. A woman who owned a Cadillac, for instance, would go over to the Cadillac man and he would tell her how to more intelligently manage her machine.

All of that gives publicity, is a definite service, and helps promote public

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safety. I have found this: that there is nothing that puts the rocks under the foundation of your whole proposition like giving some definite, constructive service. That is the thing that the citizens appreciate.

Let me sum up here the things that are really determining in a public safety campaign, that really put it across.

FUNDAMENTALS OF A PUBLIC SAFETY CAMPAIGN

I would say fundamentally, to have that committee we were talking about. Without that you cannot do much; your movement will never have the standing that it might. Then I would say that the second thing, fundamentally, is to get the proper system of safety instruction in your schools. You want to guard against half-baked systems because school people will sometimes take the line of least resistance, and will say they are giving safety instruction when they are merely giving a thirty minute talk on Friday afternoon, and putting up a few pictures. That will never get anywhere. We tried it for ten years and didn't get anywhere.

I believe safety instruction should be incorporated in the curriculum so that it literally becomes a part of the child's life and thought every day. That is what I mean, and I say that is the second thing.

The third thing in importance, is to absolutely have your police force with you, and the best way to do it is to get the chief and mayor to call them together, if possible. We called together fifteen hundred policemen, for the first time in the history of St. Louis. There was a great deal of value in having the authorities stand up there and say, "Men, get back of this thing!" And the police force were a big factor in the success of our wonderful week in 1918. If you can have your police captain go on record in favor of the thing, the policemen will say, "Well, I guess this thing is all right."

I know that one of the things I did in Baltimore was to talk before nine precinct meetings of policemen, and the police captain or head officer was with me. And the police did their part during that week in bringing about the record of no accidental deaths.

The next thing is the newspapers. If you have organized your committee, and your vigilance committee, at that point you can get publicity and you can get about all the publicity that you can furnish material for. The secret of publicity is to furnish proper material.

Next in importance is the vigilance committee, and finally, the chauffeurs' school. I put that there because it only reaches a certain number and these other things reach the whole city. I believe those things are the very backbone of your public safety work.

MR. H. A. RENINGER (Lehigh Portland Cement Company, Allentown, Pa.): Is your committee made up of officers of the law?

CHAIRMAN PRICE: No, ordinary citizens. In your town, you would want to have one hundred men, for instance, each man pledged to report any violations that he sees. There are printed cards containing the names of perhaps two dozen violations. He checks the violations that he sees and signs it, sending it to the chief of police.

MR. RENINGER: The vigilance committee is composed of the leading citizens of the city. And do they prosecute?

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CHAIRMAN PRICE: That has been tried, and it has some dangers. It requires very careful training to enable an ordinary man to exercise the proper authority. He makes a mess of it sometimes.

Another thing is that there is danger of prejudicing the public against your safety effort. It is better to have that fall upon the shoulders of the police. Your vigilance committee does the reporting and the police take the blunt end.

MR. RENINGER: But nobody knows who the vigilance committee is, and they do not arrest unless it is absolutely necessary. That is the way we worked it out. Where they get a fellow who refuses to give his name, for instance, then they have the authority to do it.

CHAIRMAN PRICE: It is a fine thing if it is not exceeded. They have had trouble in the authority being exceeded in some cities.

MR. HILL: Are there some particular persons who act as a vigilance committee? It seems to me anyone could do it—pedestrians, or drivers or anyone else. Wouldn't it be better to have everybody reporting the cases?

HOW VIGILANCE COMMITTEES WORK

CHAIRMAN PRICE: The secret of a vigilance committee is to train it properly, and you have to have men, irrespective of where they come from, who are interested and will attend meetings where they receive instructions. It requires instruction to make a real vigilante. There are a great many cases where he doesn't know what to do. A vigilante doesn't want to exceed his authority. It has always been found necessary to have a monthly meeting of the vigilance committee, to which the men would bring their problems. Gradually the men are trained to do the work intelligently. So I wouldn't do it in a wholesale way; I would fill up the ranks of the vigilance committee rather carefully.

In some cities the reports of the vigilante go direct to the chief of police. For the first offense, they send a polite letter, assuming that the man meant all right but simply made a mistake, and speaking of the effort to make the streets safe and asking his co-operation. I read a large number of replies that were received, not long ago, and practically every one of them were courteous. They were glad to have their attention called to the matter and promised their co-operation.

For the second offense a drastic letter is written, and the third offense means an invitation to come to the office of the chief of police.

The vigilance committee idea is in the making yet, gentlemen, and in our local council managers' meetings, the one thing we have agreed on is that we must carefully instruct the members of our vigilance committees. It is not an easy thing to be a good vigilante—it is a matter of judgment.

MR. LIPPINCOTT: When these cards are made out and handed to the chief of police, does the man who makes out the card appear?

CHAIRMAN PRICE: In the vast majority of cases nobody has to appear. The man is called in, and the chief of police assumes that the report is true, and the man pays his fine, you see. But in a small percentage of cases it is necessary for the man to come into court, after having reported a case.

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None of the cities have made a perfect success of this vigilance committee work, and they claim it has been because the members of the committee were not properly instructed or disciplined—that they used bad judgment and didn't understand the thing.

MR. D. R. FARIES (Automobile Club of Southern California, Los Angeles, Calif.): The police department's co-operation is one of the first things that should be obtained, but what do you do when you don't get it? For example, some of our cities live off the motorist. They collect hundreds and thousands of dollars from motorists. So you can talk with the chief of police and head of the traffic squad, and say, "We want you to educate these people so that they won't make the mistakes again." And they will say, "Fine—fine!" But the fine is what they are interested in and nothing else. They don't want to educate the motorist. It would cut off their revenue if they did—that is the truth of the matter. They don't want the accidents stopped—they want to pick up so many a day to turn in a certain amount of fines to the city treasury.

What are you going to do if a community is taking three hundred thousand dollars a year out of motorists? And if you say anything to them, they promptly reply, "Well, show us where we can get the money elsewhere."

CHAIRMAN PRICE: Until you can get a group of citizens on the side of justice you can't do anything. You are up against it.

MR. FARIES: Another thing: What are you going to do when anybody in your town can send a card in to the chief of police and say "You arrested a man yesterday who is my cousin. Don't do anything to him." What can you do then?

CHAIRMAN PRICE: Fundamentally there is only one hope or solution of the automobile problem, which is perfectly obvious, and that is to develop public sentiment or public opinion. The only way to develop public opinion is by organized effort. We never did it in any other way.

It all comes back to the fundamental thing that we talked of from the start: Whenever we get people of sufficient influence interested, so that Mr. Municipal Judge and Mr. Chief of Police will take notice, then we commence to get law enforcement, because the real folks in town are back of it.

Now is there anyone who questions the practicability of having a vigilance committee? Is there anyone who doubts the advisability of bringing that committee together and trying to educate them so that they will do intelligent work?

Gentlemen, you not only train your men, you not only instruct them, but you keep them interested, you keep the thing alive; and the trouble is, with some vigilance committees, that they have two hundred members, and only twenty-five really alive. They have no way of keeping the thing going.

MR. FARIES: I will tell you how to stop that. When the committee man turns in a report he doesn't know what becomes of it in the vigilance committee. That is the last he hears of it. Now, a good thing to do is, when you get a report, to drop a note to your vigilance man and say,

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"Thank you for the report. We have done so-and-so." He will be interested in that. Or it may be necessary to wait a few days or a week, for action, and then write him a letter saying, "You will recall reporting such-and-such a case. That man was sent to jail yesterday for five or ten days, or fined fifteen dollars, and we want to thank you for the part you have taken in helping to make the streets safe."

CHAIRMAN PRICE: That is a good thing. The men know that they are actually accomplishing something that way.

NO-ACCIDENT WEEK DEMONSTRATIONS CONVINCE THE COMMUNITY

We must now pass on to the next thing we want to discuss. I want to strongly recommend that once a year you conduct a no accident week. We have all found that the best way you can initiate a public safety movement in town is to have a no accident week. If you develop an organization that is efficient to put across a no accident week, it is pretty sure to be a good organization to carry on permanently. We find that we can attract people into an organization to put across a no accident week, that we might not be able to do if we were organizing without any special thing to do.

Another thing I want to say, and this is more important, is that we find that nothing convinces like a demonstration. The thing seems too impossible to grip the interest of a whole community, and to do anything. A no accident week convinces them.

MR. LIPPINCOTT: Would it be any advantage, in forming the local council, to start off with a no accident week?

CHAIRMAN PRICE: If you organized it with public safety I don't know of anything better. No accident week is so closely allied to your public safety movement, that your permanent organization will be simply a continuation of no accident week, somewhat slowed down—that is all. No accident week is a very effective way to start.

Take, for instance, Milwaukee. Most of you know, of course, of the success of no accident week there last year. A year ago in July the town of Milwaukee was absolutely unorganized as far as public safety was concerned. And now Milwaukee is one of the very best organized cities for both public and industrial safety in the United States. It is one of the two leading cities, and it all happened in twelve months. The no accident week was the secret of its success. It literally gripped the whole community.

FINANCING A LOCAL COUNCIL

We will now touch on the financial program. I should say that the most difficult problem of a local council has been the financial problem. As most of you know, the plan that worked out most successfully in financing the industrial activities has been to assess them on a pro rata basis. Some have had a rate of seven or ten cents per employee per year. That worked out very nicely and the plan is acceptable to the managers. They feel that they are paying on the basis of the benefit that they will derive from the activities, and you can back it the second year and assess them on the same basis. Some will drop out and others will come

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in, but on the whole that plan has proved satisfactory, and in most towns you will have to take the number of industries that you can assess, find out how much money you have got to have, then divide it and figure up how much it will average per employee. But somewhere along from seven to ten cents has been found to be enough for most towns. Some did try fifty cents, but failed. I don't know of any town that made a success of it much above ten cents.

For a long time we tried all sorts of plans—going around to rich men, and philanthropists, taking up collections, and so forth, and it was unsatisfactory, and also unfair.

The thing that appeals to me with the system they are now using is that it is the financing of the industrial side on an industrial basis, and one that appeals to practical business men. Each one pays for what he gets, and is paying his share proportionately with the others. He is financially interested and is paying according to the benefit he will get out of it.

PRO RATA BUSINESS PLAN OF FINANCING PUBLIC SAFETY

I got to thinking the thing over, and said to myself, "Well then, why not put the public safety on the same basis?" I worked out the plan tentatively, and went out to St. Louis and asked them to try it out. After a careful canvass of the situation they found that there were fifty-seven organizations whose members had trucks on the streets, and who were paying insurance premiums and losing money because of accidents, and who would be interested in street safety precisely for the same reason that the manager of an industry would be—financially interested. They called together the presidents of those organizations, and I think there were twenty-two presidents at that first meeting. They said something like this to them: "Gentlemen, we have a local council here, and we have financed our industrial activities in the following manner; we have done some public safety work with the following results; but we have had very meager funds and we have gotten to a point where we cannot go further. We cannot solve the public safety problem here without more money. We men here representing the local council are willing to do the work. We are interested! We are willing to do it, and we have an organization that can do it. We have worked out a program"—and then outlined to them the program that I outlined today, about the public schools and the rest. "It is a program that has been tested out in different cities and has proved to be efficient. We have gone far enough to believe that we can absolutely control this problem if we have the money. But we are not going to do another thing and are going to drop public safety work absolutely if you people here are not willing to help finance it."

Then they presented information about the number of vehicles in the association, the premium per vehicle per year, and total for the association. They continued, "Now in this association you have fifty members, and you are paying one hundred and twenty-five dollars per vehicle per year, and it amounts to so much money. You truck fellows are paying two hundred or two hundred and twenty-five dollars per truck per

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year. You have so many trucks, and it amounts to so much. Now you men are spending this much money on premiums, are you willing to pay five per cent of your last year's premium toward a fund that promises to finance an effort that will reduce the number of accidents, and thereby bring about a reduction in your premiums? At least, we will stop the injuries."

INSURANCE RATE REDUCTIONS FOLLOWING PUBLIC SAFETY WORK

Following that they read a telegram from Mr. Whitney of the Compensation Rating Bureau, encouraging them to believe that if they did make substantial reductions, that immediately at the end of the year he would make an investigation with respect to a possible reduction of the premium.

As a result of that meeting and some more that followed, they secured the pledge of nearly all of the presidents of those organizations to go back and take the pro rata share of the total and distribute it among the members, and get the money.

Then the unexpected thing happened. Those very men indicated that they would like to serve on a committee and help spend that money, and they formed a committee out of those men. I attended one of the meetings when there were about forty present, and I never sat in a meeting where the members were more interested. They got a new group of people representing organizations whose members were vitally interested.

MR. FARIES: How much money did they raise in that way?

CHAIRMAN PRICE: I think Smith told me that the amount now is over twenty thousand dollars that has been pledged. It is not all paid in.

They have gone farther than that (it is a new plan that has been worked out recently, and I am not recommending it but merely mentioning it in passing) and Mr. Smith has employed an expert on automobiles, a man who has been running a garage, and a very able man, who gives his entire time to service to members, and he can hardly respond to all the demands. Here is a trucking company that has certain trouble, and want him to come down and spend two days going over the problem and telling them what do to. That is a definite service that they are rendering for this money.

But even if they didn't have direct service, the members felt that it was worth a five per cent contribution toward this effort on the part of people who had shown that they were competent to organize a movement in St. Louis that would reduce the hazards on the street, and eventually reduce the premiums.

I believe, gentlemen, that that is the direction in which we have to work. I believe that until we get away from passing the hat, and get the thing on a basis where the men are benefited, we will not be organized on a proper basis. The plan is not perfectly worked out yet, but I believe we are going in the right direction.

This doesn't mean, of course, that they will not go to individuals who are public-spirited. But the backbone of their financial plan of public safety is going to be those who are interested for their own welfare.

The public safety financial problem is a very difficult one. We have been

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working away at it, and we have not solved it yet. This plan that I mention is very promising, but of course it will be very much modified in different communities.

That would mean that your wholesale companies, and even your manufacturers who have a number of trucks, and in fact everybody who has a commercial vehicle on the street, would be willing to pay something towards a fund that would promise to reduce his loss. The street railway paid on the basis of two per cent on their losses.

MR. H. F. LOVERING (New England Power Company, Worcester, Mass.): Are there any that appropriate any funds.

CHAIRMAN PRICE: Quite a number of local councils are supported out of the community chests. The percentage averages about five per cent.

NON-INDUSTRIAL ASSOCIATE MEMBERSHIP FOR PUBLIC SAFETY WORK

MR. COSTLEY: I should like some information on this: In this public safety movement, would you recommend getting into your local council the concerns that you know probably wouldn't be interested in the National Council, such as dry goods stores, the larger groceries that run a number of trucks, and coal companies?

CHAIRMAN PRICE: Yes.

MR. COSTLEY: But you probably couldn't interest them in taking a membership in the National Council. Now, I don't know how to go about getting them a membership in the local council.

CHAIRMAN PRICE: You can have a membership that is independent of the membership in the National. Call them associate members. Every local council is accepting firms who are not members of the National Safety Council. They have no particular representation in the council. They have the satisfaction of knowing that they are associate members and can attend public meetings. But most firms don't care a rap whether they can vote or not, and they are not slighted at all—membership doesn't mean much to them. So if you can get a grocery company that has a few trucks on the street to contribute, you are receiving some help.

MR. COSTLEY: A dollar per truck or something like that?

CHAIRMAN PRICE: Anything that is decided upon.

MR. COSTLEY: That is decided by the local council itself, I take it.

CHAIRMAN PRICE: A dollar is too small. Just remember that a truck is paying from one hundred and twenty-five dollars to two hundred and twenty-five dollars per year for premiums. That is a loss, and a man ought to pay at least five per cent, you see, toward an effort that really promises almost certainly to make some saving; and it won't have to make much of a saving to save the contribution.

MR. LIPPINCOTT: Do the insurance companies reduce the premium?

CHAIRMAN PRICE: They will reduce the premium. For instance, in Detroit they made a reduction and in Rochester they made a reduction, and the insurance companies are taking the attitude of being glad to do it if we can show reductions in accidents; because accidents have been getting away from them and they have had to keep raising the premiums to keep up. The insurance companies are ready to encourage any town

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that will show reductions. If you will write to Mr. A. W. Whitney of the Compensation Bureau in New York—the Compensation Rating Bureau—he will write you substantially what he did for St. Louis.

MR. LIPPINCOTT: That is for automobiles alone?

CHAIRMAN PRICE: We are speaking now, of course, of automobiles; but they have all sorts of insurance. They are interested particularly in this automobile problem because it is one of the things that has not been controlled. Just as they are giving the plants an experience rating and a merit rating, so their attitude is to reduce the premium if a less hazard can be shown. They can make more headway if the hazard is controlled than if it is going by leaps and bounds.

MR. LIPPINCOTT: Are you taking the question of finances in divisions outside of the public section?

TEN CENTS PER EMPLOYEE AS BASIS OF ASSESSMENT

CHAIRMAN PRICE: There are just two phases to the financial problem—the industrial, which I described first, a pro rata system on the basis of the number of employees, and the public, which we have just discussed.

MR. LIPPINCOTT: Let us go back for a minute.

What do you do in an instance where a plant has only a few employees? Do you have a certain charge for that?

CHAIRMAN PRICE: In the towns where that is worked out, we assess on the basis of the number of employees, and treat everybody alike. In St. Louis, and I think in other towns, they say that for the first thousand the rate is ten cents, and for all over a thousand it is seven cents.

If you have any troubles of any kind our office door is always open. We will be more than glad to give you any help that we can. You always have the privilege of writing to any of the managers of local councils and they will give you any information they have, so that you won't have to sail alone. We are leaning on each other.

ADJOURNMENT.

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Metals Section

September 27 and 28, 1921

JOHN A. OARTEL, Chairman
Chief of Safety Bureau, Carnegie Steel Company, Pittsburgh

J. A. NORTHWOOD, Vice-Chairman
Superintendent of Safety and Welfare, Cambria Steel Company, Johnstown, Pa.

V. H. MEISSNER, Secretary
Pittsburgh Malleable Iron Company, Pittsburgh

TUESDAY MORNING SESSION

CHAIRMAN OARTEL called the meeting to order and appointed the following as the nominating committee: Mr. Phil Stremmel, Assistant General Superintendent, National Enameling and Stamping Company, Granite City, Ill.; Mr. J. M. Woltz, Safety Engineer, Youngstown Sheet and Tube Company, Youngstown, Ohio, and Mr. T. H. McKenney, Supervisor of Labor and Safety, Illinois Steel Company, South Chicago, Ill. Secretary Meissner's report was read by Vice-Chairman Northwood, who then reported for the program committee. Mr. Walter J. Hart, Safety Engineer, Jones and Laughlin Steel Company, Pittsburgh, reported as chairman of the bulletin committee.

SAFE PRACTICES IN POURING IN A FOUNDRY

A. B. ROOT, JR., MECHANICAL ENGINEER HART-SPILLER MANUFACTURING CORPORATION, BOSTON

A few years ago foundry superintendents were very loath to take up safety committee work; they were of the opinion that the "frills" recommended by advocates of the principle were superfluous, and that the results could be accomplished by a superintendent's making rounds of the shop and keeping his eyes open to the activities of his men.

We have come to realize, however, that to a certain extent it is only through the concerted effort of a committee that interest can be aroused, not only among the men but also among the management executives, and that a decrease in accidents can be secured among metal workers.

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In sending out a few inquiries for material for my talk, one answer quite surprised me. This came from an old, established firm, in which the writer said that even today their shop was not strongly in favor of the "frills" of safety work; that their foremen took the responsibility and they considered it quite satisfactory. It is surprising today to find that attitude existing. A short time later a high official of that company, present at a meeting of foundrymen in Boston, admitted that he was "sold" on safety work. It takes meetings such as these to interest the foundry manager or superintendent in taking up the steps which lead toward a reduction in accidents. After that interest has been aroused, the first thing the foreman should do is to talk the matter over with the men. Co-operation is essential.

I am not of the belief that the foreman could, or should, do the whole job, even though he had the time, because it is, after all, the men in the shop who must be interested. It has been my experience that the best way of arousing their interest is by the formation of shop committees, not consisting of foremen, but of the men themselves. These committees should meet once a month and make inspections of the various parts of the plant. In my opinion, much of the success in safety work results from having workmen themselves represented on such committees.

If the size of the plant justifies it, it is a comparatively easy matter to install a first-aid department. It is often found quite satisfactory to have the nurse make periodic inspections of the shop and get acquainted with the men. The nurse ofter reports things not seen by others, and this results in reducing the danger to the men. At the meeting of the New England Foundrymen's Association last month a comprehensive plan was outlined by Mr. G. E. Sanford of the General Electric Company, West Lynn, Mass., which, according to the figures that he submitted, is accomplishing wonderful work. The Council's Safe Practices pamphlet No. 42 gives valuable detailed information on "Industrial Safety Organization".

DIVISIONS OF RESPONSIBILITY FOR SAFETY IN A FOUNDRY

The safety work in a foundry is in two divisions: mechanical equipment, and personnel. Some safety committees have the direct responsibility of inspecting the foundry equipment. I am not in favor of this system. If the foremen perform their duties regularly and well, they will accomplish as much as the safety committees. In the shop I have in mind, this is done. The foreman makes a weekly inspection of all equipment with which molten metal is handled; after such inspection, he makes a written report and follows it up to see that all defects are immediately rectified.

The brakes on cranes are inspected periodically by the engineering department. I do not believe this work should be left to the foreman. Difficulty has been experienced by letting the crane operators themselves adjust brakes. Likewise every chain should be numbered and inspected. While chains are not frequently used in handling ladles or metal, they are one of the most dangerous features of foundry equipment. In shops that require the use of bull ladles on overhead beams, weekly inspection of not only the beams but of the carriers is necessary. In plants where

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ladles of one to four tons capacity are used, it is of great importance to have the gearing guarded and inspected. Otherwise trouble might be caused by iron spattering and getting into the gears. Handles should be sufficiently long to enable the operator to stand far from the ladle.

The question of the ladle linings should be carefully considered. The safety committee might quickly pass over certain defects which would be detected by someone more familiar with ladle linings. The foreman should be the man to judge whether the ladles are lined properly.

Guards recommended for small ladles are fastened at the back of the ladle in a hoop-like position, and protect the men's hands from being burned.

Safe articles of clothing such as congress shoes, leggings, gloves, and goggles are essential. The recent change in labor conditions makes it easier to enforce the wearing of safe clothing. Objections to wearing goggles have been overcome.

In the summer, when it is uncomfortably hot in the shops, men are apt to go around with sleeveless shirts or shirt-sleeves rolled up. Some wear gloves; some do not. If the sleeves are up and a man wears gloves, drops of metal are apt to come down inside the tops of his gauntlet gloves.

The apron usually worn in foundries is short, covering a man's clothing to within twelve inches of his waistline. That is hardly adequate. We use long aprons. Only those pouring the larger ladles wear them. They also wear congress shoes, leggings, and safety goggles. The apron is made of abestos, put on over the head, covers below the knees, and ties around the waist. It can be lengthened or shortened according to the size of the wearer. It is stiff at first, but after being worn a week it becomes very limber and does not impede the performance of a man's work.

RESULTS OF SAFETY WORK

What are the results of safety work? One foundry has sent me the following chart showing the number of burns for the three months preceding a safety campaign compared with the number during the campaign, which lasted for three months:

Year	Total accidents per man	Burn accidents per man
1916	1.07	0.11
1917	1.20	0.15
1918	0.86	0.07
1919	0.79	0.07
1920	0.68	0.09
1921 (7 mo.)	0.22	0.02

The interesting results of such campaigns, however, are not so much the reductions secured during the campaigns, but continued results after the special campaign has ended.

Another company prepared the following report:

	Eye burns	Foot and leg burns	Other burns	Number of employees
Three months preceding campaign	3	16	13	112
Three months during campaign	0	1	5	89

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Since 1916 there has been a steady reduction, due to the regular, systematic safety work that is being carried on. This reduction means something in dollars and cents as well as in humanitarian results.

Figures from another shop divide the burn accidents in three classes. The first class is trivial burns, that do not require the services of a physician, and in which the employee loses no time. Under class A are listed the burns from which men do not lose time and are not paid compensation; class B burns are serious, the injured men losing time and receiving compensation:

Year	Trival burns per man	Class A burns per man	Class B burns per man	Total burns per man
1917	7.8	1.3	.5	9.6
1918	5.6	.5	.18	6.28
1919	4.	.48	.18	4.66
1920	3.2	.6	.08	3.88

These figures show decidedly beneficial results from carrying on active safety work in the foundry. It is not necessary to have elaborate committees to do the work, but if the employer is interested and can interest the workmen, much can be accomplished.

ELIMINATION OF STEAM DURING POURING

R. E. Shaw, District Manager, B. F. Sturtevant Company, Boston

When I was requested to prepare a paper on this subject, it seemed to me that this could readily be done by simply arising and shouting, VENTILATE!—for that is really the answer. Then, I began to wonder whether prevention could be attempted on the theory that prevention is better than cure, and after discussing this with various persons who are more familiar with foundry practice than am I, the answer seemed to be repeated, like an echo, in the word "ventilate!"

This paper should really be called "The Removal of Steam and Other Troublesome Gases from Foundries", for if we eliminate the steam arising from the moulds, we will necessarily remove along with it the gases and many of the odors which co-exist.

VENTILATING SYSTEM

This can be done only by mechanical ventilation, carefully planned and executed with the thought of results uppermost always, and if this is done, the question of the design of the foundry structure, and the arrangement of its equipment must receive careful thought so as to render it possible to design and install a ventilating system which will adequately accomplish the desired result without an unwarranted initial or operating expense.

Usually, this can be readily done in case of a new structure if we bear in mind the fact that a unit volume of air can do its utmost as an absorption agent, which it really is, in a problem of this kind when permitted

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to approach directly and to maintain the closest possible intimacy with the vapors and gases that it is expected to absorb, instead of being interrupted and harrassed in its course by posts, partitions, and counter air currents. Furthermore, a given quantity of air supplied can accomplish most by expending its efforts over a minimum space instead of spreading over a vast area.

It costs money to move air, and that is why I touch upon the importance of considering the ventilation of a foundry when it is being designed and equipped. I am not going further into this because this paper is not intended as a treatise on architecture or production.

HEATING

Foundries, like other buildings, require heat as well as ventilation, so it is natural to consider the two problems as one. It is much more economical to obtain the heat required by the foundry, through the agency of the ventilating equipment rather than from a separate heating equipment.

The heating and ventilating apparatus will consist of one or more units to supply a sufficient quantity of fresh outside air to absorb and to force out steam and gases generated during the pouring period, and may in addition include exhaust fans to aid in carrying off the contaminated air. The volume of air supplied will be greatest and at the lowest entering temperature during this period; it must be distributed evenly, preferably at relatively low velocities at a point near the floor, to mingle with, absorb, dilute, and carry off toward the point of exit, the steam and gases generated. Just how this can be done will be determined by the building construction.

Usually, foundry buildings are one story in height and disconnected at some distance from surrounding buildings. Large door and window openings and one or more monitors extending the full length are usually provided. The ratio of space in cubic feet per occupant is much greater than in machine or textile buildings. All of these features tend to produce a natural circulation of air, which, at first thought, might seem ample for ventilation.

There are, however, certain features connected with foundry work that require special consideration from the ventilation standpoint in addition to the removal of the steam generated during pouring, which we have previously mentioned. These features are:

1. Heat radiated from the cupolas.
2. Heat given off by the large masses of molten metal.
3. Wood smoke that is frequently present in considerable quantities due to frequent practice of heating the portable ladles used to convey the melted iron, by burning wood in them. This smoke is very irritating to the eyes and lungs. There is also smoke from burning flasks.

There are two distinct periods in the operation of the foundry:

1. The time in which the workmen are engaged in setting up the moulds.
2. The period during which the metal is poured, and castings knocked out of sand.

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It is in this second period that we are chiefly interested, but we cannot neglect the first one in our discussion.

During the first period the problem is largely one of heating. This is very similar to that of any other manufacturing plant since there is no heat given off due to work being done. It is usually necessary or desirable to heat the foundry during this period to from 55° to 65° F. in extreme weather. In this climate you will have to provide apparatus to maintain that temperature when the outside temperature is minus 10° F. However, during the heating season, from October to April, the average temperature in New England is 37° F. Therefore, to maintain a uniform temperature in the foundry with varying outside conditions, it is necessary that the heating equipment be flexible, and we have an ideal flexibility in the equipment necessary to ventilate when it is used also as a heating apparatus.

During the second period much heat is given off by the molten metal in the moulds and in the ladles, with the result that not so much outside heat is required as when the moulds are being set up. Furthermore, during this period ventilation is the chief requirement. This is easily and positively obtained by the use of the ventilating units.

VENTILATING UNITS

Each unit consists of three parts:

1. A heater, usually composed of a series of cast iron bases into which are inserted 1 inch pipes; the number of sections being such as to permit any desired temperature rise of the air passing through them; each section being fitted with individual supply and return valves for this purpose. The heater may be supplied with steam at any desired pressure or with hot water.

2. The second part of the unit is the fan with its driver. This must be carefully selected with regard to the maximum volume of air required, and with careful consideration of the resistance against which the fan must work under these conditions; also, the volume required under ordinary heating conditions which we have previously called the first period of operation, because it would usually not be good practice to select a fan which will operate with the minimum power during the pouring period, as the first cost of the unit would be too great and, therefore, a selection should be made of a fan which will operate at its greatest efficiency during the ordinary heating period, but with capacity to give the volume required during the pouring period, even though the efficiency during this time is somewhat lower. This applies chiefly where the pouring period is only a small part of the total number of hours work; and if the foundry is of such a capacity that the pouring period is relatively long, then the fan should be selected to give the maximum efficiency during that time. The fan may be driven by belt from line shaft, by motor, or by steam engine; the latter being used when high pressure steam is available. If this exists it is the best drive to employ because exhaust steam from the engine will be used in heating coils so that the power cost is very small; exhaust steam being worth 80 to 85 per cent as much as live steam, for heating. A second especially attractive fea-

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ture of engine drive is the flexibility which it provides for varying the air volume.

3. The third part of the primary ventilating unit system is the duct work for distributing the air.

AIR DISTRIBUTION SYSTEMS

Two systems of air distribution are in use: the overhead and the underground. In the overhead system the ducts are usually of galvanized steel; the main pipes usually being carried under the roof trusses so as to be out of the way of cranes and other equipment. Drop pipes are taken from this main at various points and discharge the air at a relatively low velocity near the floor. These outlets should be spaced as closely together as possible to provide a large volume of uniformly distributed warm air to absorb the steam, smoke, and gases, and carry them upward where they will pass out through monitors, ventilators, or auxiliary exhaust fans. If, as is frequently the case, overhead cranes are provided to transfer the metal and the finished castings, more or less difficulty is likely to be experienced in locating the outlets, and this, therefore, requires careful planning on the part of the designer of the system.

A better distribution can usually be obtained by using underground ducts of masonry, tile, or other suitable material. Where a new foundry is designed this ought to be carefully considered. The underground system of ducts will likely cost more than the exposed metal ducts, but it is much better, as outlets can be taken off at almost any points desired. Air will be discharged from vertical risers, near the floor, the same as in the overhead system.

It is impossible to lay down any law as to the volume of air which should be supplied since this will vary according to the construction of the building and the character of the work. Generally speaking, a low building will require a more frequent air change than a high one. Again, if the work consists of small castings where the moulds can be grouped closely together for pouring, and there is a large amount of space outside of the pouring floor, where there are no moulds, it is possible to concentrate the air during the pouring period, so as to remove the fumes from that portion of the building and prevent them from going into the rest of it, but if practically the entire foundry floor is covered with moulds, then it is necessary to figure on the same air change throughout.

During the pouring period, outside air should be used exclusively, and, except in extreme weather, very little heat will have to be imparted to this incoming air. For this reason it is wise to arrange the heater with a by-pass which will reduce the resistance against which the fan will work when handling the maximum volume, and mean a saving in horsepower in the driving agent. In the summer time the fan will be used during the pouring period to supply outside air; the heating coils being shut off entirely. In addition, the unit should be arranged with a return connection to the heater intake chamber from the foundry, as there may be periods when the air can be either entirely or partially recirculated.

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EXHAUST EQUIPMENT

In some cases it may be necessary to supplement this supply equipment with exhaust apparatus. If the foundry is not provided with monitors of some sort, then it will be necessary to furnish exhaust equipment, which may either be in the form of propeller type fans placed in the building walls or roof, or some type of ventilator which will not permit a back draft. If monitors exist they should be equipped with louvres or shutters which can be opened on either side, and should be opened on the side away from the wind, or else guarded against wind pressure which will force air into the openings instead of allowing the exhaust air to escape. Frequently this feature is lost sight of and then the owner of the foundry wonders why his ventilating system sometimes operates and sometimes doesn't.

I personally am opposed to dependence on monitors only for the escape of air, and I think that a good ventilator is much superior, and an exhaust fan still better.

In conclusion we can say, therefore, that the successful elimination of steam during pouring depends entirely upon the use of a properly designed ventilating system, properly installed and properly operated. No two installations will be exactly alike unless the building and all other details of operation are the same. Failure is almost sure to result if an attempt is made to construct a foundry without due regard to the ventilation, or if the first cost is the primary consideration.

This means that the problem should be put into the hands of a competent engineer who should be allowed to work out the scheme with due regard to results to be accomplished, and the cost be the last thing considered. Many jobs fail because an attempt is made to compromise between results and expense.

ELECTRICAL HAZARDS IN FOUNDRIES AND STEEL MILLS

WALTER GREENWOOD, SAFETY ENGINEER, CARNEGIE STEEL COMPANY, YOUNGSTOWN, OHIO

(In Mr. Greenwood's absence, his paper was read by Mr. C. H. Liebfried, Safety Engineer, American Mutual Liability Insurance Company, Boston.)

The subject seems to imply that there is a difference in the hazards connected with employment of electric current in the various classes of industry. So far as foundries and steel plants are concerned there is no difference other than that involved in different methods for performing operations.

Various kinds of accidents occur from operating electrical equipment, but reasons other than faulty and incomplete equipment or carelessness have seldom been offered to account for their occurrence. Elaboration on all the causes for accidents that occur through employment of electric current would require a discussion of prohibitive length; therefore, we will try in this discussion only to explain why some of the requirements for safe construction and safe operation are demanded.

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There is a distinction between electrical hazards chargeable to direct contact of the person with electric current and those chargeable to operation of mechanical equipment that is electrically operated, and the relation between them is such that a discussion under the title of this paper requires consideration of both.

LACK OF KNOWLEDGE OF PRINCIPLES OF ELECTRICITY CAUSE OF ACCIDENTS

Technical description of the construction of electrical apparatus for the performance of various operations does not convey the knowledge as to why it cannot be made harmless under any and all conditions. Describing accidents that have occurred does not prevent the occurrence of similar accidents in other places where the surrounding conditions are a little different. Demonstrating the peculiar action of electricity does not give much of the desired knowledge. The matter is one of such great complexity that, unless it is extensively discussed from all angles, little beneficial information can be added to what already has been published, all of which is well understood by manufacturers of equipment and by those in charge of operations—the electrical superintendents and their skilled assistants. There are others connected with operating called operators and construction men, and usually their knowledge of the principles governing the generating and distribution of current is very limited. They commit many errors that cause accidents because of lack of knowledge which, if fully possessed, would prevent them from violating safety rules. Some men fail to observe rules for controlling distribution of current, most of which require action and supervision by the station superintendent who is in charge of control board. These rules regulate cutting out current from equipment when for any reason it is necessary for a person to come in contact with current carrying parts or mechanical parts electrically operated; they also regulate restoring the current when the operator is convinced that conditions are right for doing so. It is of course desirable to remove from easy contact dangling wires that might become charged. Operators sometimes fail to cut out current from sectional systems when those systems are no longer needed; they may replace blown-out fuses with wire of capacity above rupturing requirements; or they sometimes block in circuit breakers to compel apparatus to perform work in excess of its normal capacity.

Construction men may leave wires dangling within easy reach of workmen; these wires may be connected to a dead circuit that is likely to remain dead. While most men know they should not touch a dangling wire even though they feel sure it is dead, some of them may find out it is harmless and soon all the others are acquainted with the fact. All at once the wire becomes charged, either purposely or accidentally, but the fact is not manifest; then someone, presuming the wire to be dead because it was known to be a short time previously, touches it with serious result. This example, with modifications to suit, is typical of many accidents where persons are killed or injured by electric current. Persons have been killed by current drawn from the atmosphere through steel frame umbrellas they were carrying, and in one instance three young ladies were killed at the same time by current when under one

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umbrella. Yet only a few will be deterred from carrying steel frame umbrellas during a storm, by reason of this statement.

When a controller is left on and the circuit is broken by opening the main switch, it is possible for someone to close the main switch, or it is possible for a short or cross to by-pass the controller and cause an accident by starting machinery or by causing a shock to someone who may be in contact with current carrying parts.

Since bad results do not always follow overfusing or blocking circuit breakers to permit of carrying overloads, this encourages many operators who do not understand the hazard involved, to indulge in these bad practices in disregard of instructions not to do so. The contact points or blades of operating controllers may stick whether or not distant control is employed, and frequently damage results before the circuit can be broken. Distant control is mentioned because many are of the erroneous opinion that accidents or mishaps cannot occur where it is employed. Could operators realize that overfusing or blocking in circuit breakers is the same in effect as rendering a safety valve on a boiler or an open throttle valve on an engine inoperative, they would not do such things. The damage that can be done is limited in extent only by other protection, if any is provided, and sometimes the damage extends back to generators with consequent opportunities for accidents.

Switch blades or control contacts are of various designs according to the service demanded of them; some being comparatively fragile. Because any of them may stick if overheated, none should be so arranged that they cannot be made visible for inspection while the current is on.

OVERLOADING ELECTRICAL EQUIPMENT CAUSES ACCIDENTS

Overloading equipment is probably responsible for as many accidents as any other single cause. It results in breakage that may be immediately followed by injury to persons, or in impairment that later results in breakage and consequent personal injuries. Overloading sometimes results through ignorance of persons authorized to decide what a piece of equipment shall do, regardless of protests that may be made by operators or other employees connected with the work of caring for and maintaining it.

The importance of isolation has been dwelt on to such an extent in former discussions of electrical hazards, it might seem unnecessary to enlarge here on what has been said. While no one would attempt to minimize the importance of isolation, the limits to which it may be carried by reason of lack of capital must be recognized. However, this should not abate the insistence of demand for it.

A rather common kind of accident is for a person on a metal structure to touch a high tension wire and get the current through him. If a structure is perfectly insulated, current could not go through it to ground, therefore no injury could result from contact with one conductor while on the structure. Persons may frequently have been in contact with dead metal parts and current carrying parts without receiving injury, and this leads them to ignore the principle, if they ever understood it, that if such metallic parts are grounded they will complete

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a path through which current can travel to ground. Assuming that the structure or metal parts are not grounded but that they are in contact with current carrying parts then if a person standing on the ground is brought in contact with the structure or metal parts, he would complete a path to ground. As the likelihood of a person forming a path between live parts and grounded dead parts is less than the likelihood of forming a path between dead parts accidentally charged and grounded parts, it is best practice to make the electrical grounds to all dead parts.

Maintenance of equipment in proper condition is largely the responsibility of inspectors. Breakage of parts weakened by wear, and failure to keep parts properly keyed, bolted, and lubricated have been responsible for many accidents. The remedies for such accidents must suggest themselves to the person in charge of operations.

Lack of ruggedness in equipment is responsible for many accidents; breakage and unusual exposure to hazard may result when men are hurrying to prevent loss. It is difficult to control the handling of equipment so perfectly that unusual and excessive stress will not be put on it, and such excessive stress many times impairs the parts that necessarily are delicate but can fail only because of failure of more rugged parts. In many cases the matter of locating and repairing failure of delicate parts exposes someone to hazard.

STANDARDIZATION OF ELECTRICAL EQUIPMENT AS A SAFEGUARD

Standardization of parts of equipment or principles that should be followed in construction, is important because it includes ruggedness which lessens breakage; interchangeability and easy access which shorten delays; simplicity of operation which lessens the cares and anxieties that disconcert the minds of operators; and uniformity of arrangement. As an example of this last point, it is advisable to standardize the arrangement of controllers so that operators changed from one piece of equipment to a similar one will not be likely to operate the wrong controller because the order of another arrangement is so firmly fixed in mind that the mind automatically prompts operating the wrong one.

Abuse of equipment is responsible for a big hazard. It cannot be so ruggedly constructed that abuse will not impair it, and inspection cannot be so closely followed that parts weakened by abuse will not fail at a time when results might be serious.

Operation of equipment by persons not authorized or qualified is dangerous. If not authorized they may endanger someone through lack of information as to surrounding conditions. If not qualified, they may be the cause of an accident because they do not know that control of an apparatus is sometimes dependent on other factors than operating controllers, like filling an air tank to operate brakes. They may be ignorant of operating requirements and may fail to do any of the many things that should be done for avoidance of accidents.

Failure of employees to co-operate is responsible for many accidents. This particularly applies to operators, inspectors, and repairmen, who should at all times notify each other of their intended actions in order that one may not do anything that will endanger another.

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TEACHING EMPLOYEES TO GUARD AGAINST ELECTRICAL HAZARDS

A difficult question to answer is, how are we going to make the hazards of electrical equipment so well understood that almost anybody can avoid them or guard against accidents? The U. S. Bureau of Standards has issued a handbook of instructions for properly installing equipment, giving special instructions for avoidance of accidents. The National Board of Fire Underwriters has issued a similar code, though much more brief. The industrial commissions of some states have issued codes governing making intallations insofar as the avoidance of accidents is concerned.

A knowledge of some of the facts concerning electric current and equipment without knowledge of others, where the facts seem to contradict one another, is what often leads to trouble, for experience has taught that under one set of conditions there is no hazard, while there were no lessons of experience to teach that under other conditions there is a hazard.

It can be shown that before the present intensive movement for safety began, the causes of 80 per cent of all electrical accidents could be equally divided between unguarded or faulty equipment and carelessness. At the present time but a very small percentage of this 80 per cent can be charged to faulty or unguarded equipment, and it can be said of these and the other 20 per cent, a better understanding of the fundamental principles involved in generating and distributing current, which would involve an understanding of the varying conditions where hazard may or may not exist, would result in further reduction.

DISCUSSION

MR. J. R. MULLIGAN (Bethlehem Steel Company, Bethlehem, Pa.): In handling hot loads in the foundry, is it best to use cable slings or chains?

MR. C. H. LIEBFRIED (American Mutual Liability Insurance Company, Boston): I would not think that cables would be the proper thing to use over a hot load. A cable usually has the wires wrapped around a hemp core which has a good deal of lubricant in it. Great heat would cause such a cable to deteriorate rapidly.

MR. T. H. MCKINNEY (Illinois Steel Company, Chicago): We use wire cable slings exclusively in our hot metal plant. Cables that are exposed to great heat have special soft iron cores.

MR. FRANCIS FEEHAN (Pennsylvania Department of Labor and Industry, Pittsburgh): Should the use of protective clothing and eye protection in foundries be required at all times?

MR. ROOT: That is a much discussed question. I am in favor of doing it, however, in the most hazardous departments.

MR. FEEHAN: I consider protective clothing, and head and eye protection just as necessary as a safeguard on a hazardous machine. The most practical way to insure its use is for the employer to say to the workman, "You are employed here to do this work; you must use this protection, and you will not be permitted to work here without it." This has been done successfully by many employers. It has been my experience that the only concerns that have trouble with their employees in this con-

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nection are those who provide protective clothing and head and eye protection, and say, "It is optional with you whether you wear them or not."

MR. NORTHWOOD: Our company requires the men to wear head and eye protection and safe clothing. The men themselves have come to the point where they will not work without them.

MR. MULLIGAN: We have a Goggle Code which stipulates the different lines of work requiring the use of goggles, and our men are absolutely compelled to use goggles on these jobs. The same ought to be true in using leggings when pouring metal, etc.

CHAIRMAN OARTEL: I would like to ask Mr. Shaw how to provide good ventilation for an old foundry; assume that it is an old building that was not laid out in accordance with the latest engineering principles.

MR. SHAW: It is necessary to treat every problem individually, so I can answer in a general way only. If the foundry roof is low and broken up by beams, with many little alcoves in it, you have a very difficult problem. You may have to install several ventilating units to take care of your conditions. It may be necessary to provide a three-minute air change; perhaps only a five-minute air change. In addition to providing a fresh air supply you may have to furnish some way of getting that air out. That is where many ventilation schemes fall down, because there is no exit provided for the air.

I had a job not long ago where that subject was brought up, and when I got all through the man told me that the expense involved was unwarranted; that he would rather shut his foundry down for a period after pouring. Of course when business isn't very good and he has more capacity than he needs, he hesitates to go into the ventilation because he can pour late in the afternoon, then shut down and let the ventilation take care of itself. But when he gets up to normal production he will have to reconsider the matter.

Each case presents different problems that must be solved individually. Many men say, "I want nothing but standardized units." When you come to ventilation, it is pretty hard to standardize.

MR. ROOT: I would like to ask Mr. Shaw what the advantages of the central heating system are, over the individual heating systems of the same cubic foot capacity?

MR. SHAW: There are unit heater systems which furnish the heat supply through steam. There are individual unit heater systems which are direct fire because many foundries do not have boiler capacities to use steam. These, as a rule, have the disadvantage that you cannot get the air in sufficient volume, and they don't have the ability to force the heated air to the points in the foundry where it is needed. Then too, if you need ventilation, it is necessary to have outside air, which cannot be provided by the unit heaters. Furthermore, unit heaters require individual attention.

MR. F. W. RUSSELL (Crouse Hinds Company, Syracuse, N. Y.): We have a ventilating system in our foundry which is about 740 feet long. This makes it possible for our shakers to work in the foundry and shake out the molds very soon after they are poured. Formerly this was impossible, especially in the winter time.

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MR. FEEHAN: It has been my experience that every instance where an adequate system of ventilation has been installed in a foundry, it has added materially to the plant efficiency and has been one of the best investments of the concern. It increases the efficiency of the workmen; it safeguards the health of the workers; it helps to eliminate accidents, and brings many other advantages.

ADJOURNMENT.

WEDNESDAY MORNING SESSION

CHAIRMAN OARTEL called the meeting to order, and introduced Mr. Marquard as the first speaker.

SAFE PRACTICES IN BY-PRODUCTS COKE PLANTS

F. F. MARQUARD, SUPERINTENDENT, BY-PRODUCTS PLANT, CLAIRTON WORKS, CARNEGIE STEEL COMPANY, CLAIRTON, PA.

(In the absence of Mr. Marquard, his paper was presented by Mr. M. L. Champion, Safety Engineer, By-Products Plant, Clairton Works, Carnegie Steel Company, Clairton, Pa.)

The modern complete by-product coke plant has many departments which are similar to departments in the steel plants. I will comment on the safety features of the various departments making up a complete by-product coke plant—coal handling, coke handling, gas handling, tar handling, ammonia and benzol recovery, distillation, refining, and shipping. I will omit hazards characteristic of boiler operation, machine shop and pipe shop operation, power house and pumping stations, etc.

COAL HANDLING

In all modern plants coal handling is done chiefly by the use of belt conveyors. In a number of plants the coal is lifted from barges but in the majority of plants it is unloaded from cars. The Clairton by-product plant, which is the largest coke plant in the world, receives practically all of its coal in barges.

One of the great hazards in hoisting coal from barges is the danger of lumps of coal falling from the hoisting bucket. There is also danger of men being injured by the bucket as it is lowered into the barge, especially during the clean-up stage. This hazard attracted our attention and we designed a bucket which enables us to clean up a barge without the use of clean-up men. Thus we not only eliminate one of the most hazardous operations in this work, but we also effect considerable economy by this elimination. The operators soon learn to clean up the barge by allowing less than a ton of coal to remain after the cleaning up period without the use of any clean-up men, and further the operators, on account of not having to watch clean-up men during the clean-up stage of the operation, are enabled to unload the barge in practically the same time as was previously done by the aid of sixteen clean-up men.

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CRUSHING

In the crushing of the coal considerable dust is formed, especially when coal is comparatively dry. This is a hazard to the health of the men as well as a fire hazard where this dust gathers in undisturbed places. We have succeeded, by the introduction of a small amount of steam just below our crusher, in allaying this dust condition in a most satisfactory manner. We have also installed air lines in our conveyor galleries which are used periodically for blowing dust off ledges, motors, and other machinery.

We have discovered in our operation that the hand tightening of conveyor belts offers a hazard that has proved quite serious in several instances and we have overcome this by the introduction of weighted take-up tighteners which operate automatically and keep proper tension on the belts all the time. This safety measure not only eliminated the hazard of hand tightening but also enabled the operators to keep proper tension in the belt; it improved the operating conditions of our conveyor belts very materially, eliminating excessive clamp troubles and slipping conditions encountered during cold weather.

Of course, all the usual precautions are taken, such as covering pulleys, enclosing counterweights, guarding gears, installing safety walks for oilers, prohibiting the use of open lights around dusty places, providing a signal system for starting belts, arranging frequent stations along conveyor gallery for operators to stop the entire conveying system at a moment's notice, and installing guarded ladders in the coal bunkers, etc.

The safety records of our coal handling department for the past three years, during which time over 12,000,000 tons of coal were handled, show only two lost time accidents during this entire period with an average daily force of 50 men.

OVENS

Safety precautions about the ovens are a subject of the utmost importance. In addition to the hazard of moving machinery, such as larry cars, pushing machines, door extractor machines, quenching cars, mudmills, etc., we have to contend with oven gases, leaky doors, heat flashes from charging holes, dust, and hot tar splashes.

The larry car travels along the top of the ovens and is dangerous at all times. It requires extreme precaution on the part of the operator to avoid accidents due to the fact that there is always a more or less gaseous atmosphere and men working on top of the ovens cannot always see the larry cars approaching. These cars are provided with loud sounding gongs which operate continuously while in motion. Ample clearance is provided so men can step aside while the larry is passing.

To an inexperienced person it would seem that the lidmen, the men who do the charging of the ovens and luting of the lids, would be subjected to great danger of being overcome by gases in which they are obliged to work during the charging process, but owing to the fact that the men take advantage of the winds and because the work is done in the open air, there is practically no danger whatever from gases. The greatest danger about this work is the likelihood of a flash when the fine coal is charged into the hot oven.

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During the summer months particularly, the excessive heat in which the men are obliged to work makes these jobs quite undesirable. However, owing to the frequent spells that these men get during the charging operation, they have an opportunity to get into shelter places provided at the end of each battery and rest in comparative comfort during the spell intervals. Drinking fountains, shower baths and sanitary stations with locker rooms are located at various points convenient to the men.

Many items comparatively small have been introduced in various ways to eliminate hazards about the ovens, such as special made bars for men to open standpipe lids without danger from the flash, wooden soled shoes for the men who work on top of the ovens, leather frame goggles for the men who work around hot places on dusty days, portable lighting poles suspended from collector rails to facilitate the luting of oven doors at night, the interlocking signal system in the pushing of ovens, a safety tunnel to prevent men passing over the quenching tracks, the equipment of all moving machinery with automatic gongs, the provision of plenty of light for night operation, the construction of racks in proper places for keeping tools off the floors, warning signs placed in conspicuous places throughout the plant, and personal educational work especially with new men who are being broken in on their jobs.

A good lighting system is a very important safety measure about a by-product coke plant where continuous operation is necessary, especially along benches which we find impossible to guard with hand railings; also in the alleyways beneath the benches where there is danger of being burned by gas ignition if an open flame is used. Broad walkways and platforms along gas collecting mains are necessary in order that gas inspectors and tar chasers may be able to work in safety away from flashes.

The total number of lost time accidents about the ovens during the past three years, in the coking of over 12,000,000 tons of coal with a daily average of over 300 men, amounts to 64 cases, 38 of which occurred during the first year of operation.

COKE HANDLING

The coke handling department takes charge of the coke after it has been quenched and dumped on the wharf. The fine coke dust resulting from the handling and screening operation makes it necessary for the men who are working in these places to wear goggles and dust protectors, especially on windy days. Most of our eye injuries happen to new men. We have practically no eye cases from older men, even though they do not wear goggles. Dust protectors and goggles are provided to the men free of charge.

The conveyor belts carrying the steaming hot coke up the incline and over the screens are subjected to very severe treatment and quite often it becomes necessary to stop them for repairs. To overcome danger of accident being caused by someone starting the belt while repairmen are working on same, all starting switches are locked before repairmen start on the belt.

Another important feature in connection with the development of the large Clairton by-product coke plant is the use of combination electric

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storage battery and third rail electric locomotives for spotting the cars under the coke loading station. These locomotives are remote-controlled by the loader stationed at the point of loading; this eliminates the necessity of men working about the cars or loading tracks as is the case where rope haulage is used for spotting cars under the loading station. In addition to the safety feature of these electric locomotives, their flexibility makes their operation very economical in coke loading. Sanitary stations, drinking water fountains, shower baths, and lockers add considerably to the comfort and satisfaction of the men working in this dusty place, and I wish to emphasize the necessity of convenient locations so that men are able to utilize them at intervals throughout the day.

During the last three years, in the handling of 7,800,000 tons of furnace coke; 720,000 tons of coke dust, and 300,000 tons of domestic coke, with an average force of 42 men we have suffered only 5 lost time cases, 4 of which occurred during the first year of operation.

GAS HANDLING

The successful installation of a by-product coke plant depends upon the careful design of pipes handling the gases from the ovens to the recovery apparatus and the accurate control of the movement of the gases. The hot gases, approximately 600° F., traveling through the collecting main, travel at a rate of approximately 4 feet per second, and through the suction mains at approximately 20 feet per second. These pipes are so designed as to condense a certain portion of the tars in their travel to prevent pitch stoppages. Very careful control of the gas burners as well as temperatures is a most essential factor in the successful operation of a by-product coke plant.

Many dangerous and disagreeeable duties are forced upon men in a plant where this important factor in by-product coke oven operation is not efficiently managed; such as, overcoming pitch stoppages in collecting mains and damper boxes, carbon stoppages in ascension pipes, and napthalene stoppage in condensing apparatus. All of these operations necessarily must take place along the hot mains in contact with hot gases and hot tar.

In the processes of condensing tar and ammonia, and extracting the benzol vapors, it is found necessary from time to time due to stoppages, and for the purpose of cleaning out apparatus, to open up such apparatus as tar extractors, ammonia saturators, benzol oil scrubbers, etc. In every case where it is found necessary to open up a piece of apparatus through which gas has been passing, after the valves are tightly closed, this apparatus is thoroughly cleaned out. Where the valves do not close completely we have often found it necessary to insert blanks at flange connections to be absolutely sure that there is no gas leakage into the apparatus where the men are obliged to work. The use of white mice lowered into places which might be suspected of having gas pockets serves in many cases as a good index of the atmospheric condition.

Reliable gas masks are kept in good condition and located in conspicuous places ready for immediate use and the men in charge are thoroughly drilled in the proper use of same.

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It is a routine duty to drain out drip pots in underground gas lines, and oftentimes after the liquor has been drained there is an escape of gas which overcomes the men. We have a rule that the man in charge must always be accompanied by a helper during this operation; in fact, at all places where repair work takes place inside of gas handling apparatus there is a strict rule to the effect that a man must be accompanied by his helper or foreman while he is working in same, and proper provision must be made for his immediate exit if he shows any indication of being gassed.

The by-product building, in which most of the ammonia and gas handling apparatus is located, is equipped with an overhead crane. However, on account of gas leakage in this building it is not safe to operate this crane by electric drive; this crane should be operated either by hand, or preferably by compressed air.

Many safety features have been installed in the gas piping and apparatus in connection with the safe handling of the gases; pressure gauges at specific locations, keeping a close continuous record of the gas pressures at definite places; thermometers placed at definite points along the travel of the gas to keep a perfect continuous record of the temperatures. These continuous recording charts enable the operator at a glance to see irregularities creeping into the operation and enable him to check same before any dangerous condition is developed.

Walls have been placed in trenches to prevent fires from traveling into the buildings through the underground trenches; effective ventilators are provided for taking fumes out of the building; vapor-proof globes are used for all lighting; all electric switches are on the outside of the building; all doors open towards the outside; rooms are well lighted; as much apparatus as possible is painted a light color so as to detect any leaky condition of same, and this last at the same time increases the effectiveness of the lighting of the operating room.

AMMONIA

In the operation of a by-product coke plant the ammonia from the gas is recovered primarily in two forms: one in the form of ammonium sulphate, a white salt, and the other in the form of ammonia liquor. Most modern plants effect the recovery of ammonium sulphate by passing the gas through lead lined saturators containing a 5 per cent solution of sulphuric acid. The ammonia is combined with the sulphuric acid forming ammonium sulphate and the gas passing through this acid solution is freed from its ammonia content. This salt, in the form of a slushy mass of crystals settles in a cone bottom saturator and is syphoned by an air ejector upon a lead lined table. In this operation the fumes which are lifted up with the sulphate crystals and mother liquor are very pungent, being highly contaminated with phenols and pyridine vapors. These fumes in many plants have been allowed to discharge directly in the building, thus contaminating the air and in general making the operating conditions very bad.

In recent construction these fumes are collected in a large lead lined pipe and conducted through the comb of the building out into the

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atmosphere. This safety feature has made the operating condition very much more agreeable in the ammonium sulphate recovery house.

The slushy salt crystals which are unloaded on the table are paddled velocity of 700 revolutions per minute. The steam engines used in driving these centrifugal dryers are practically all of the vertical type engine and have been the cause of numerous accidents. These engines must be stopped and started frequently; this the operators do, contrary to directions, by moving the flywheel with their feet or hands after the steam has been turned on. This habit has been overcome by the introduction of a crank handle fastened to the shaft, similar to that of an automobile. This is a very successful safety feature, completely removing the hazard from this operation.

In the sulphate recovery department it requires a ton of sulphuric acid for the production of a ton of ammonium sulphate; consequently the operators have to do considerable handling of concentrated sulphuric acid. This acid is delivered in tank cars and is unloaded by compressed air into overhead storage tanks. The men in charge of this operation are obliged to wear goggles, rubber gloves, and rubber aprons to avoid being burned by acid spillages which occur during this unloading process.

In the production of ammonia liquor the chief hazard has been from ammonia fumes which have filled the room, due to leaky conditions developed in the piping and in the apparatus. This is not only a hazard but a waste in the operation, and strenuous efforts are made in the construction of this apparatus to see that the piping and flanges of the apparatus are well constructed; the slightest leak of ammonia is immediately attended to.

Another hazard in the ammonia house is the slaking and handling of lime; frequently the milk of lime is splashed into the eyes of the workmen and in handling the bulk lime the lime dust gets into the nostrils of the workmen. These workmen are supplied with goggles and dust protectors free of charge. All the buildings should be well ventilated and well lighted, and apparatus should be painted a light color as much as possible to enable the operator to detect the slightest leak, as well as to assist in the lighting of the building.

In the handling of the gas from the coking of 12,000,000 tons of coal we have had but 13 lost time accidents during the past three years; 5 the first year; 7 the second year, and one to date this year.

BENZOL

The benzol department consists of three distinct stages: first the absorption stage; second, light oil distillation; and third, washing and refining stage. In the absorption stage the gas, after the ammonia has been extracted, is passed through large towers which are filled with wooden grids over which petroleum oil, of certain specifications, is circulated until this oil becomes saturated to the extent of 2 per cent of benzol, after which it is passed through steam heated continuous stills and the benzol vapors are driven out and condensed and known as light oil. The petroleum oil, which is only the carrier, is cooled off and returned to the scrubbing towers to again be saturated. This is a continu-

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ous process. In this operation it is important to observe the regulating of the circulation so that the oils are not excessively saturated to a point where benzol vapors are allowed to escape and form an explosive mixture in the base of the scrubbing tower.

In the cleaning out of these towers it is absolutely essential that large volumes of steam and water be used, not only to remove all gases in the tower, but to wash out the benzol sludges which form gases when disturbed by the workmen in their repair work.

The cooling of the gases is effected by circulating large volumes of water before the gas enters the oil scrubbers. The circulation of this water over the cooling tower makes it necessary on frequent occasions for workmen to clean out distribution pipes on top of these towers, and it has been found that the contaminated atmosphere created by the air passing through this cooling tower is extremely poisonous, and therefore great caution must be exercised when performing this work. It was discovered in this work that the cleaning of these distributing lines could be done with much less risk if the work was done before the sludge had an opportunity to dry, and also if the operators took the added precaution of performing this work with the hose type gas mask, permitting them to breathe the outside air while working in these cooling towers.

In the past three years, in the coking of over 12,000,000 tons of coal, this process has caused but one lost time accident.

The washing, refining, distilling, fractionating, and shipping of benzol products involve a multitude of small operations; the opportunities for benzol vapor to escape into the air through leaky pipes and apparatus are very numerous; however, we maintain rigid supervision and education of the operators and well constructed distillation buildings; in addition, there is ventilation for light vapors through the roof and forced ventilation for the heavy vapors through pipe trenches on the floor.

This plant has operated practically full capacity during the past three years, having recovered over 36,000,000 gallons of benzol without a single lost time accident, making the benzol department, from a hazard point of view, one of the safest departments in the by-product coke plant.

A number of precautions should be observed in the operation of the benzol plant—first, the benzol plant should be enclosed completely by a solid brick or concrete fence so as to prevent firing of small oil leaks that might escape and run out into the open and become ignited by passing engines and follow back into the plant; second, all storage tanks and all apparatus where explosive mixtures might occur should be grounded; third, a system of fire protection should be installed, which system would enable a fireman to extinguish oil flames by flooding the oil surface with a light fluffy alum and soda solution, thus eliminating the air and smothering the flames. Fourth, all wiring should be permanently installed in conduit and lights equipped with vapor proof globes, and all switches placed on the outside of the building. Fire escapes and exit doors should be placed at convenient places for operators. No matches, smoking, or open lights should be allowed inside of the benzol plant. Fifth, the foremen should all be well trained in the use of pulmotors and in the prone pressure method of resuscitation and thoroughly educated

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in the method of completely eliminating benzol vapors from tanks before making repairs. Air hose masks should be used by all workmen who are cleaning or repairing benzol tanks. No man should be allowed to do any repair work in dangerous places without being accompanied by helper or foreman.

In general it is well to keep in mind that owing to the noxious fumes, smoke, gas, and dust about a by-product coke plant, there seems to be a psychological effect on the workmen that such prevailing conditions are not conducive to good health. This is purely psychological, and to overcome this feeling it has been found very desirable to have a by-product coke plant kept in the pink of condition; grass plots and shrubbery; roads covered with crushed limestone; ample sanitary conditions; shower baths; cool drinking water; ample lighting; and in all departments rigid inspection and removal of any refuse should be kept uppermost in the minds of the men. At all times a rigid campaign of education should be conducted through periodic safety meetings in all departments, and a full discussion and rigid examination of causes and remedies of accidents should be made not only of the local plant, but of all other plants conducting similar operations.

DISCUSSION

MR. H. J. WEEKS (American Steel and Wire Company, Pittsburgh): Have you experienced any trouble with the electric mule third rail system for the handling of cars when snow piles up over the third rail in the winter time?

MR. CHAMPION: No.

MR. WEEKS: How do you protect the motors used for the coal handling system from dust? Are they isolated in a separate room or are they of a ventilated or a gas-proof type?

MR. CHAMPION: We have the air system around through our conveyor galleries and at certain intervals during the day they are blown out with air. Furthermore, I believe there is ventilation to the outside; the air is passed continuously over the motor, keeping it cool and also drawing the dust out. We also inject steam in our crushers as well as at the end of the belt where the coal transfers from one belt to another. This helps considerably in keeping down the dust.

MR. WEEKS: The coal handling system in our by-product coke plant is operated by solidly-encased motors, with two pipes leading to the outside of the building—an inlet and an outlet. In the coal crusher buildings we have the gas-proof type motors, which also work out very satisfactorily.

MR. CHAMPION: There is one trouble with the hand operated crane; the men, when through working, instead of running the crane back to the end of the building walk the rail. There is danger that they may fall, particularly if they are a little bit dopey. That is the main reason why we began to look around for some other way of operating the cranes. We have now installed compressed air and it is very much easier to get the cranes back to the landing platform. Later, we are going to build a walkway down the center of the building, so the operators can get on and off at any point along the runway.

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MR. J. A. VOSS (Inland Steel Company, Indiana Harbor, Ind.): Several years ago we had an overhead electric crane traveling from the by-product building into the gas-engine room. While removing a part from a gas-engine a spark from the electric crane caused an explosion and fire and one man was killed. Since then we have put a brick wall up to the roof between the gas-engine room and the by-product building, and we are now using the electric crane in the by-products room only; there is a hand operated crane in the engine room.

MR. NORTHWOOD: What is your scheme for tightening the conveyor belts?

MR. CHAMPION: It is a weighted take-up which keeps tension on the belt at all times.

MR. VOSS: Do you provide safety cables on those weights?

MR. CHAMPION: The weights are so situated that there is no chance of anybody getting under them.

MR. VOSS: We have found it necessary to provide an extra cable that we call a safety cable. We have an eight-ton concrete weight; sometimes the clamps become loose, so we put on a safety cable to prevent the weight from dropping through the floor.

MR. WOLTZ: In cleaning your tanks, do you do more than just steam them?

MR. CHAMPION: We steam them from twenty-four to thrity-six hours before we allow anybody in.

MR. WOLTZ: Then do you fill them with water, after steaming them?

MR. CHAMPION: No; we use white mice to test in there; lately we have also been using the hose type gas mask, with about 150 feet of hose.

REPORT OF NOMINATING COMMITTEE

MR. WOLTZ: We present the names of the following persons to be considered for your officers during the coming year:

For chairman, Mr. J. R. Mulligan, Bethlehem Steel Company.

For vice-chairman, Mr. J. A. Northwood, Cambria Steel Company.

For secretary, Mr. Walter Hart, Jones & Laughlin Steel Company.

(Upon motion, duly seconded, the report of the nominating committee was accepted, and the secretary instructed to cast a unanimous ballot for the men suggested.)

SAFE PRACTICES IN ROLLING MILLS

FRED JOHNSON, SUPERINTENDENT OF ROLLING MILLS, SOUTH WORKS, AMERICAN STEEL AND WIRE COMPANY, WORCESTER, MASS.

Our discussion will be based on several years' experience in the rolling mills of the American Steel and Wire Company at its South Works plant, Worcester, Mass. Our roller mill equipment includes 34-inch two high reversing blooming mill; 20 inch three high merchant mill; 16 inch continuous billet mill; three 10 inch to 12 inch rod mills, and roll turning shop.

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All these mills, including furnaces, engines, etc., and also the roll turning shop are located under practically one roof in cramped quarters. We consider that the physical arrangement of our mills adds in no small degree to the normal rolling mill hazard.

The operation of these mills requires about 225 men, not including auxiliary employees such as machinists, boilermen, engineers, yard employees, etc. About 30 per cent of these men are highly skilled, another 30 per cent are semi-skilled, and the remainiing 40 per cent are unskilled.

The following table gives our accident record for the past ten years, including all "lost time" accidents which have occurred in our rolling mills. A "lost time" accident is any injury which causes an employee to lose more than the balance of the day on which he is injured.

ACCIDENTS IN ROLLING MILL

	YEAR										
Nature of Injury	1912	1913	1914	1915	1916	1917	1918	1919	1920	1921	Totals
Burns on body	3	4	1	4	7	..	3	..	..	..	22
Burns on hand	2	1	2	..	..	..	1	..	..	..	6
Burns in eye	3	..	..	..	..	2	..	..	..	..	5
Body injury	5	1	1	1	2	1	1	..	..	..	12
Foot injury	6	6	1	3	9	9	5	4	..	..	43
Arm injury	4	2	1	3	3	1	2	..	..	..	16
Hand injury	10	7	6	4	9	4	1	..	..	..	41
Leg injury	2	4	3	3	2	2	2	..	..	..	18
Scalp wounds	5	3	1	1	3	..	..	..	..	..	13
Eye injury	2	2	2	1	1	1	..	..	..	..	9
Fractured skull	..	3	..	1	1	1	1	..	..	..	7
Sprains	4	3	2	3	2	1	..	..	1	..	16
Strains	3	1	..	3	7	1	1	1	..	..	17
Septics	4	1	2	3	4	1	..	..	..	..	15
Hernia	1	..	1	2	1	..	1	..	1	..	7
Fatalities	1	..	..	..	..	1	..	..	..	..	2
Total	55	38	23	32	51	25	18	5	2	..	249
South Works, Accidents	351	422	204	237	300	143	80	44	41	14	1836
Rod Mill Entitled To (Per Cent)	8	8	8	8	8	8	8	8	8	to date 8	8
Has Had (Per Cent)	15	9	11	13½	17	17½	22½	11	5	..	13½

The description of safe practices as applied to the actual operation of rolling is somewhat difficult, but I will try to picture to you some of the things we do.

COBBLES

I shall use the term "cobble". A cobble in our works occurs when a bar of hot steel fails at any stage of the rolling process to proceed in its normal course through the mill. From the time we start rolling the 4-inch billet practically all our equipment is what is called "continuous", that is, the stands of rolls are set tandem, and the bar being rolled passes automatically from each stand of rolls to the succeeding stand, and each succeeding stand of rolls revolves at a rate of speed sufficiently increased to take up the elongation of the bar resulting from the reduction in sectional area in the previous stand. This results in very high speeds as the bar nears the finishing end of the mill. For example, in one instance we reach a speed of 1,000 revolutions per minute, which means that the bar is being delivered from the rolls at a speed of about 3,000 feet per minute.

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When a cobble occurs the bar is likely to shoot in almost any direction, and you can easily imagine that it shoots fast. So far as possible, we put screen enclosures around our fast running rolls, to confine cobbles to as restricted an area as possible, but this can be done in only a few cases, because it interferes with the operation of the mill. Where it is not possible to screen the mills, the safety of our men depends solely on their watchfulness.

Just as soon as a cobble occurs we proceed to get it out of the mill as quickly as possible. Speed is necessary (1) to reduce to a minimum the delay in producing; (2) the removal of cobbles is much simpler if it can be effected before the metal cools.

The most important thing to look out for in removing a cobble is to ascertain whether the end or any part of the bar is in such a position that it is likely to be caught in any of the moving parts of the mill during the process of removal. We never stop the engine if we can help it, because the resulting loss of time makes this impractical, but very frequently a cobble will be in such a position that a little movement of it with a crowbar or tongs will cause it to catch in the rolls and create an extremely dangerous condition. So the man whose duty it is to remove the cobble at the particular point where it occurs, first investigates this point. If he finds the cobble in such a position that there is any chance of its becoming caught, he either has the mill stopped, or, in the case of small sections, cuts away with an axe or bolt cutter enough of the bar so that so little is left that even if it does catch in the rolls, no danger can result. During this procedure he watches very carefully to see that he does not get any part of his body inside a loop which would act just like a slip noose, should the end start into the rolls while he is doing it. The freed parts of the cobble are then taken away from the mills by men designated for this work, and the man who is removing the cobble proceeds to take out the remainder, and correct the trouble.

In the case of a multiple line mill—a mill where as many as six bars at a time may be running through the same stand of rolls—it is rarely possible to stop the mill to remove a cobble. In such a mill, extreme care must be exercised all the time. Ninety-nine times out of a hundred. cobbles occur as the first end of the bar goes through the mill, and the man who is working about the mill always keeps his eyes open especially wide until the first end has successfully entered all the stands in his immediate vicinity.

TIGHTENING NUTS

In our daily repair work, we constantly have to tighten nuts by hammering on a wrench with a sledge hammer. In this work one man holds the wrench, and another wields the sledge hammer. The man who holds the wrench has to see that his hands are so placed that if the wrench slips his fingers will not be caught; he must always stand on the proper side of the wrench so that if the man with the hammer strikes a glancing blow he will not be hit by the hammer. The man with the hammer very often has to strike heavy blows in places where the free natural swing of the hammer is interfered with by contiguous apparatus. Under these conditions he has to be very careful to see that the swinging ham-

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mer is not deflected from its intended course. We have had cases where a third party was hit by a sledge hammer, because the striker failed to hit what he was aiming at and the force of his undelivered blow swung him entirely around.

When changing rolls care must be exercised particularly to guard against fingers being pinched or feet being injured. Men are prone to leave nuts, bolts, wrenches, etc., in positions from which they may fall. We use care in making our hitches so that there is no chance for slipping.

BIG REPAIR JOBS

When we start any big repair job—and it is these unusual jobs involving the handling of heavy machinery which often result in accidents—we hold a big safety meeting first. So far this year we have done two such jobs. We had our 34 inch blooming mill down for three weeks. We took out and replaced everything down to the foundation, and did a lot of work on the foundation itself. This job involved about seventy-five men and the handling of some of our heaviest machinery. We started the job with a safety meeting on each shift, and we talked sense to our men and talked it in such a way that they knew we meant what we said, and they knew it was to their personal interest to do the job without accidents. And we didn't have even a near accident.

We had our 16 inch billet mill down for two weeks to repair foundations. This mill is in an old wooden building, and all the heavy material had to be handled with small chain falls. We had to shore the building, and in taking out the main shaft—some 30 feet long and weighing about 7 tons—we had to block up under it inch by inch. We started this job with safety meetings as in the blooming mill job, and talked safety to our men ceaselessly. We feel that good management, not good luck, pulled off this job without an accident of any kind.

CRANES

Electric traveling cranes are the source of many of our worst accidents. Our officials have told us these accidents must stop, and we are industriously engaged right now in stopping them. We insist that crane operators speak English. A well paid and competent head crane operator has general supervision of the eight cranes and sees that new men are properly broken in. Each new man is required to spend enough time in the electrical shop to enable him to pass an examination prescribed by the master mechanic. We tell our crane operators not to move a crane under any circumstances if they discover men working anywhere near the crane runways. We insist that they obey this rule even to the extent of stopping production. This same procedure applies to men who are handling material to be transported by the crane. If the operator is in any doubt whatever as to the safety of anything in connection with the operation of his crane, he is not permitted to use his judgment at all, but is taught to stop the crane, find his foreman, and get instructions from him. We recently had to discharge one of our good men because we failed to get across to him the fact that he must in no case use his own

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judgment. We provide the switches of our cranes with Yale locks and give each operator a key; this is to prevent the operation of cranes by unauthorized persons. The head crane operator sees that each of his operators reads our printed crane rules at least once a month.

HANDLING BILLETS

In the year 1919, of our five lost time injuries, four were foot injuries in connection with the handling of 4 inch billets going to our furnaces. About 65 per cent of the 4 inch billets used in our rod mills are produced on our blooming mill. The balance come in from other sources in broad gauge cars.

The billets from our blooming mill are loaded hot onto narrow gauge buggies by a traveling crane, being piled very similar to cord wood, with the exception that they often lie more or less irregularly on the buggies. These buggies when loaded are hauled into our yard by a locomotive, and this moving of the loaded buggies results in still further disarrangement of the billets on the buggies. When we are ready to use these billets—and this is often done while the billets are still hot—the buggies are again pushed by locomotive under a traveling crane equipped with a scoop attachment so arranged that the scoop slips underneath the billets piled on the buggy to lift them off. However, the capacity of this crane and scoop is such that only part of the billets can be taken off the buggy at a time. In this process of unloading these billets, the furnacemen have to assist, standing on the ground beside the loaded buggies. As the crane lifts its load the remaining billets roll down, often falling to the ground. This constitutes a very dangerous condition and a large part of our accidents in previous years have come from this source. This work cannot possibly be guarded by a safety device—it is a question of the man himself. We keep incessantly talking to our furnacemen about this proposition. We keep telling our crane boys who work with the furnacemen not to make a move with the crane if they think the furnacemen are taking the slightest chance. In one or two cases we threatened to discipline men who were reported to us as taking chances on this job. We have not had a foot injury for nearly two years.

WIRE ROPE SLINGS

In practically all our crane work we use wire rope slings in place of chains, as a safety measure. If we find it necessary to carry dangerous loads over the places where men are working, we require these men to stop work until the load has passed. We don't allow horseplay or fooling of any kind in our mills.

SCRAP BALLING

The control of our scrap balling machines is so arranged that the machine operates only so long as the operator holds his finger on the starting button. In addition to this, as a safety precaution, we never permit one man to operate this type of machine alone. There must always be at least two men on the job.

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The men who give the signals to start our engines know that it is part of their job to make sure that there are no men in places where they may be caught. We haven't had an accident of this kind for years.

ROD MILL

In rod mill work we have always fastened the stretcher blocks on our spindles with band wire, because it does the job well and is very easy to take off and put on quickly. It is dangerous, however, because where the ends of the wire are twisted together a sharp projection remains which acts much the same as a projecting set screw on a revolving shaft. Several years ago one of our men was killed when his jumper was caught in this way, and he was pulled in between the revolving spindles. The best safeguard to use here is a sheet iron cover completely enclosing the spindles, but these covers are a nuisance in the operation of the mill. We have tried strips of leather nailed to the stretcher blocks, canvas straps with buckles, ordinary hemp rope wound around the stretchers, sheets of thin gauge steel covering the whole of the stretchers and spindles. None of these is satisfactory, and at present we are again trying enclosing the spindles with sheet iron guards.

In years past we have had some serious injuries and some very narrow escapes when men's clothing wound up on the revolving wabbler ends of the rolls. Of course it is a simple matter to cover these wabbler ends with sheet iron guards hung on the roll housings, but these guards are always in the way and it is almost impossible to keep them on the mills. At the present time we are trying a cylindrical sheet iron cup, preferably smooth on the outside, with springs inside which make it cling to the wabbler.

EDUCATIONAL METHODS

We have been talking Safety First more or less systematically and seriously for perhaps 15 years. In the early days of safety work, our conception of the problem was to build safety devices to make our apparatus fool-proof. Some of us fooled ourselves that in safety devices lay the solution of the problem. After a few years of industrious construction of safety devices, we found that though we were making progress, the greater part of our accidents were of such a nature that safety devices could not be applied, and under the direction of our officials we began to see the necessity for education of the individual employee—for the development of safe practices, not as opposed to, but in addition to and supplementing safety devices.

In this connection I want to call your attention to what I consider is the one thing which more than any other has enabled us as a department, as a works, as a district and as a company, to eliminate 90 per cent of our lost time accidents. In years gone by the success of rolling mill operation was gauged by tonnage produced and cheapness of production. When I was put in charge of our rolling mills, we, like our predecessors, had big tonnage and low cost absolutely clearly in mind as the main things we should strive for. And like our predecessors, we strove for them. And still like our predecessors, we attained them. Of course, dur-

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ing all this striving for big tonnage and low cost, we kept hearing from our officials "Safety First", but it never once occurred to us that they actually meant it, not first before tonnage and cost. And so for several years we worked for Safety First after tonnage and cost. But the time came when some of us woke up to the fact that this Safety First talk meant Safety First, not after production and cost, but *first*—ahead of everything.

I know now that, as the immediate executive of the South Works Rolling Mills, my first and most important duty is to see that my department is operated without accidents. And knowing that, fully convinced of it, I and my assistants are applying to the ancient problem the same study and work which brought record tonnages at low costs, with the result that we are eliminating accidents. The cornerstone of safe practices in rolling mills is a determination on the part of our executives to produce safety first—then produce steel; and the realization by everybody in the organization, particularly the workmen themselves, that this is what is wanted and will be insisted upon.

We carry the safety message to our men in various ways. Of course, we have regular safety meetings every month. We use bulletin boards with all sorts of bulletins. We make large use of irregular safety meetings, meetings where we get together two or more men and talk over with them the safety aspects of their particular jobs. This is a daily occurrence, just as much as actual rolling of steel. We make a particular point of following up in this way near-accidents. Of course, when an actual accident occurs, we immediately get together in small groups the men likely to participate in a similar accident, explain to them fully the details of the occurrence, get their suggestions as to prevention of a recurrence, etc., but we consider it vital to do this also in the case of accidents which nearly happened, but didn't.

We never fail to nail on the spot any of our men whom we see doing work in an unsafe way. This is extremely important in getting to our men the absolute conviction that our safety talk is not "hot air", but that we mean it. It takes a lot of time, but it is worth it. It is absolutely demoralizing to our safety propaganda for any one of us in authority to wink at violations of the safety code.

I have a man upon whom I can depend who regularly inspects our safety devices and reports in writing to me. If he finds a piece of apparatus operating without its safety devices in place, we immediately stop rolling and we don't start until the safety device is in place.

When we first started the use of goggles in our rolling mills, we had to fight to get our men to use them, but now it is recognized as the regular thing to wear goggles when grinding, chipping, etc., and the men doing this work chase us for goggles. We have not had an eye injury in our rolling mills for nearly four years.

We have many cases of scale or particles of dirt lodging in men's eyes. We used to maintain a regular crew of "eye pickers" in the department. We don't permit this at all now, but insist that each case be handled by our hospital.

We have spent a great deal of time preaching to our men the need for

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getting hospital treatment for slight injuries to avoid septicemia. We have not had a septic case in our department for nearly four years.

CLEANLINESS

We consider cleanliness and orderliness a very important part of our safety work. We believe it is impossible to operate our rolling mills safely unless we keep things where they belong, and also, keep them clean. It is an undeniable fact that our insistence upon keeping our mills clean and orderly reacts upon our men so that they not only become more careful about the physical condition of the place where they work, but inevitably at the same time they become more careful about the ways in which they work.

TAKING CHANCES

Though our work is hazardous and our men are always more or less in danger, it is a fact that the great majority of our accidents are the result, not of this normal hazard and danger, but of somebody's taking a chance. In the old days it was considered quite the proper thing to take almost any chance rather than delay production. Today things are different—so different that I sometimes give way to the feeling that we are getting to be mollycoddles, some of us play the game so safe. Once the idea takes root that a mill must be operated without accidents, it follows that the practice of taking chances is unsafe, and must be eradicated.

The workmen must not be merely ordered and exhorted to do their work safely, but men of an analytical turn of mind must study specific jobs, work out the details of safe practice for each, and then those in positions of authority must see to it that these conclusions are made rules and enforced.

DISCUSSION

MR. NORTHWOOD: Why don't you use the magnet in handling the billets from the car, in preference to the scoop?

MR. JOHNSON: There isn't head room enough; then too, the billets are hot.

MR. W. B. EWING (Wheeling Steel Corporation, Wheeling, W. Va.): How do you keep sparks from flying over the blooming mill through your rolls?

MR. JOHNSON: Our roller platform isn't located over the feed rolls as it is in most mills; it stands to one side of the roll crane, and to protect the rolls (we have three men on that platform—the engineer, the lift weight man, and the roller) we use wire glass. We had quite a fight to get the wire glass in. We formerly used plate glass. It kept us so busy putting it in, that we were working without any glass half the time; so we finally put the wire glass up. They complained for a while that they could not see through the wire glass, but they have now gotten so they can see through it.

MR. EWING: In chipping billets we require all our men to wear goggles.

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Our safety inspectors go around and have the foremen lined up so that they will speak to each man individually about it, and in two years and a half, in all the chipping we have done, forging of billets, etc., we have never had any eye accidents.

NEW DEVELOPMENTS IN GAS MASKS

GUY H. BURRELL, MINE SAFETY APPLIANCES COMPANY, PITTSBURGH

Many of you have no doubt heard rumors concerning the development of a carbon monoxide gas mask during the past two years. One year ago I had the pleasure of addressing the Metals Section of the Council on the subject of the carbon monoxide gas mask, at which time the mask was pretty well along. So far as gas masks as a whole are concerned, there haven't been many new developments. In the past two years, the gas mask, starting from its use in the army, has gotten into a well developed field in industry and at the present time there are about ninety-five diversified industries that are using the gas mask in one form or another.

The ammonia plants are the largest users of gas masks; they have refrigerating machines and there is likelihood of a burst in any of the pipe lines at any time. For the first time in the history of refrigerating plants, they have real protection. Many different devices have been developed for the protection of men around refrigerating plants, but the army gas mask is more satisfactory than any of the others. The use of these gas masks ranges from ammonia plants down through the chemical plants and other industries.

The general design of the gas mask has not departed materially from the original army mask. We have considered different designs; one with the canister carried on the head; another with the canister carried on the back and under the arm-pit; but the final and best design for all purposes seems to be the conventional face piece, with the sanister carried on the front.

Probably one of the most important recent developments of the gas mask in the industrial field has been the application of it to fumigation work. Hydrocyanic acid gas, it has been found, is an excellent substance to use in destroying all kinds of vermin. The result has been that this gas is very widely used in the fugimation of ships, houses, and (in California) fruit trees. Hydrocyanic gas is not much more toxic than carbon monoxide gas. The trouble with it is that if you go down with hydrocyanic acid gas, there isn't much chance. On the other hand, we have known cases where men have gone down with carbon monoxide and have been resuscitated. We now have a gas mask that gives excellent protection against the deadly fumes of hydrocyanic acid gas.

About two years ago our company undertook the development of the carbon monoxide mask. We very shortly found out, however, that there was a great deal of work that had to be done in order to put it on a basis where it would be really valuable.

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The carbon monoxide mask was first sought by the navy because of the carbon monoxide content of the air in the gun turrets of the men-of-war, especially when the guns were in heavy action. When the men opened the breach of a gun the wind would blow the gases from the explosion back into the turret, and if all of the guns were firing they soon had a very hazardous condition which necessitated rapidly changing the crews. The problem was put up to the United States Bureau of Mines and the Chemical Warfare Service and the result was a carbon monoxide gas mask for the use of the navy, which did very well under the conditions. The temperatures were not very severe, the concentration of gas was not very great, and it was only a step for the man to get out of the turrets and escape from the gas entirely.

Carbon monoxide gas, as you all know, is very deadly. The blood of a normal person takes up about two pints of carbon monoxide. A man breathes approximately ten to twelve pints of air per minute and 60 per cent of the carbon monoxide that is in the air that he breathes, is absorbed in his system. If air containing one-tenth of one per cent of carbon monoxide gas is breathed, a man would require about two and one-half hours normal breathing to absorb about one-half pint. The blood takes up carbon monoxide gas about 350 times as rapidly as it takes up oxygen, and the men collapses when he consumes about one-half pint. High carbon monoxide simply means, so far as the physiology of the proposition is concerned, lack of oxygen, because the carbon monoxide combines with the hemoglobin of the blood and prevents it taking up oxygen.

Carbon monoxide is an odorless gas. The reason we sometimes smell carbon monoxide is because of the accompanying gases. Carbon monoxide is more dangerous, therefore, when all of these accompanying odorous gases have been washed out. Clean gas is much more dangerous than dirty gas because you can't smell it.

The active ingredient in the canister of the carbon monoxide mask, for want of a better name, is called "hopcalite"; it occupies the upper half of the canister. Hopcalite is a mixture of metal-like oxide—about 75 per cent manganese dioxide and 25 per cent copper oxide. It is what we call a catalytic agent—something which by its mere presence causes two other substances to react. The hopcalite unites pure oxygen with the carbon monoxide, changing it to harmless carbon dioxide.

Hopcalite is more or less affected by moisture and works at its best when dry. So in the bottom of this canister we have a drying agent which simply removes the moisture from the gas before the gas comes in contact with the hopcalite. Thus the carbon monoxide enters the canister, is first dried of its moisture, then comes in contact with hopcalite and is converted to carbon dioxide. The air, which is heated in the reaction, is cooled by means of a small inlet, and so when it reaches the face-piece it is not uncomfortable to breathe.

One development in connection with the carbon monoxide mask which has made it much more valuable than it appeared to be at the outset, was a means of telling when the canister was exhausted. We can't smell carbon monoxide, and the first indication that the canister is exhausted

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might be a weakening in the knees and then collapse. It is, therefore, a very important feature of the mask to be able to tell when the canister has given out. This is done by means of a time indicator with a glass on top of it.

We know that the dryer in the canister has a capacity for so much moisture. When it nears its capacity for absorbing moisture, we want to discontinue using the canister. We have therefore set this timer so the needle will go around once in about two hours' time; and when that needle does go around, it is an indication that the canister is nearing exhaustion and that a new canister should be used. A very generous factor of safety is allowed in the event that the timer should not function or a man should not watch it.

About forty days ago our Mr. Riggs used one of these carbon monoxide gas masks while helping to fight a fire in a large mine near Pittsburgh. He was in the mine from 5 P. M. to 6 A. M. We have also made a number of tests with the mask worn by different people in rooms containing from one to 4.5 per cent of raw blast furnace gas, or in other cases as high as 3.2 per cent of carbon monoxide.

Another pretty broad use for a carbon monoxide mask is in connection with fire departments; for this use a different style of mask has been developed. When gas masks first came out, a warning was spread broadcast through the country against the promiscuous use of them, especially by fire departments, because carbon monoxide gas was likely to be encountered at any time and the ordinary gas mask offered no protection. The Bureau of Mines has since taken samples at actual fires and, if I remember correctly, the highest amount of carbon monoxide gas that was encountered was about one-tenth of one per cent. This is very dangerous and can easily cause a man to collapse.

Carbon monoxide gas, because it is a little bit lighter than air, is extremely difficult to hold in any one place. Last summer I was at a blast furnace in the Pittsburgh district; one of the blast furnace workers came up to me and complained that at times he had to work in an atmosphere containing as much as 6 per cent carbon monoxide and he thought he ought to have something to protect him. That simply illustrates the exaggerated ideas of some people concerning the amounts of carbon monoxide gas they are apt to run into. As a matter of fact, it is so difficult to hold carbon monoxide gas in any one place that you simply can't hold a toxic concentration for any length of time, provided you have any ventilation at all.

We have made the carbon monoxide mask as light in weight as possible, thinking that it could in a measure take the place of the heavier oxygen breathing apparatus, because it is difficult to get men to wear the latter.

There is one feature in connection with this mask that we haven't said very much about; that is, with the mask on you cannot die of carbon monoxide poisoning but you can die from lack of oxygen. You can go into an atmosphere of 100 per cent carbon monoxide gas and you wouldn't get any carbon monoxide gas through the canister. Neither would you get any oxygen. I simply make this statement to illustrate

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the great efficiency of this particular material in removing carbon monoxide gas.

DISCUSSION

MR. VOSS: Do you recommend the use of this gas mask in a confined area where there is no fresh air available?

MR. BURRELL: No, we decidedly do not. The gas mask will never take the pace of oxygen breathing apparatus for use in confined spaces where you haven't any ventilation.

MR. WEEKS: Is there any particular danger in wearing this gas mask in a confined area, provided the wearer keeps his head?

MR. BURRELL: To illustrate that particular point I might refer to the case of Mr. Riggs, who was in a very confined area, three thousand feet underground. He was not familiar with the mask at all; he was an oxygen breathing apparatus man, and the only instructions that he had were to watch his safety lamp. At one particular place his safety lamp grew dim. When the atmosphere contains less than 16 per cent oxygen it is not sufficient to maintain life or a flame. So he immediately withdrew a few feet and the flame brightened.

We see no particular danger in wearing the gas mask in semi-confined spaces if a man uses his head. If he wants to be absolutely sure that he is safe he should carry a safety lamp. We don't want to go into an explosive gas, such as carbon monoxide, with an open flame.

Furthermore, if you run into high percentages of carbon monoxide—one per cent content, for example—the canister will get extremely warm in half an hour's time and will become rather uncomfortable. The man should then come out and allow the canister to cool. In 4 per cent of carbon monoxide it will get hot within a few minutes. The heat of the canister is thus an unfailing indication of high carbon monoxide gas; and your safety lamp is the thing to use in case of a confined space or a semi-confined space where there may be lack of oxygen.

MR. R. S. BONSIB (Standard Oil Company [N. J.], New York City): Would that canister absorb a combination of CO_2 and petroleum vapors?

MR. BURRELL: Yes, that particular one would. The larger one would do a little better, for in that we have some charcoal which is particularly adapted for the absorption of petroleum vapors.

DR. H. S. FORBES (Harvard Medical School): The emphasis has in the past been laid upon resuscitation rather than prevention. Prevention is the important feature and I think this gas mask performs a very useful function, and should be worn around blast furnaces and such places.

MR. J. D. JAMES (New Jersey Zinc Company, Palmerton, Pa.): We have had a great deal of trouble with carbon monoxide around our blast furnaces, spelter furnaces, and other points, and we bought an army gas mask. After experimenting we removed the canister and connected three quarter garden hose in its place. At the other end of the hose we had a large funnel which we placed in the opposite direction of the wind in order to insure the entrance of fresh air and not gas.

I would advise, when men are using this type of mask, before they commence the job, that they should clean or blow out the hose with

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compressed air twice at each end to make sure that all the oxide which has formed inside the rubber tubing has been blown out.

MR. VOSS: Can the canister be refilled after it is exhausted, or do they have to use a new canister each time? Has this mask been approved by the United States Bureau of Mines?

MR. BURRELL: In ninety-nine cases out of one hundred the hopcalite will not be harmed, and it can be recovered and put to further use. The metal canister, of course, always remains good. The actual refilling of the canisters must be atended to with a good deal of care. This is done back at our own plant, and of course the replacement canister costs less than a new one.

Our mask has not yet been submitted for U. S. Bureau of Mines approval for the reason that they require about 125 canisters and we simply haven't had the number of canisters to send over to them. We expect to submit it within the next month.

ADJOURNMENT.

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Mining Section

September 27-30, 1921

B. F. TILLSON, Chairman
Assistant Superintendent, The New Jersey Zinc Company, Franklin, N. J.

DR. A. F. KNOEFEL, First Vice-Chairman
Consulting Surgeon, United States Bureau of Mines, Terre Haute, Ind.

GEORGE MARTINSON, Second Vice-Chairman
Safety Engineer, Pickands, Mather and Company, Hibbing, Minn.

GUY J. JOHNSON, Third Vice-Chairman
Safety Engineer, Homestake Mining Company, Lead, S. D.

R. H. SEIP, Secretary
Safety Engineer, The New Jersey Zinc Company, Franklin, N. J.

DELEGATES ATTENDING MINING SECTION MEETINGS

ANACONDA COPPER MINING COMPANY—
C. W. Goodale, Butte, Montana.
H. G. BRINCKERHOFF COMPANY—
H. G. Brinckerhoff, Boston.
H. W. Brinckerhoff, Boston.
BRITISH DEPARTMENT OF MINES—
Col. J. A. S. Ritson, London, England.
CLINCHFIELD COAL CORPORATION—
J. M. Bailey, Dante, Va.
Henry Bryan, Wilder, Va.
Will Cassell, Dante, Va.
John Cochran, Toms Creek, Va.
T. P. Gilmer, Clinchfield, Va.
Frank E. Harr, Dante, Va.
R. G. John, Dante, Va.
W. C. D. Sutherland, Clinchco, Va.
R. E. Wiles, Wilder, Va.
"COAL AGE"—
F. H. Kneeland, New York City.
COLORADO BUREAU OF MINES—
H. F. Lunt, Denver, Colo.
COLUMBIA UNIVERSITY—
R. M. Raymond, New York City.
COMMONWEALTH STEEL COMPANY—
Thos. Hubert, Granite City, Ill.
CONSOLIDATED COAL COMPANY—
G. M. Gillette, Frostburg, Md.
R. L. Kingsland, Fairmont, W. Va.
J. W. Reed, Fairmont, W. Va.
CONTINENTAL CASUALTY COMPANY—
A. D. Spalding, Montreal, Canada.
DOMINION COAL COMPANY—
H. P. McDonald, Glace Bay, N. S., Canada.
ELECTRIC STORAGE BATTERY COMPANY—
H. M. Beedle, Boston.
ENGINEERING AND MINING JOURNAL—
D. E. A. Charlton, New York City.
FOAMITE FIREFOAM COMPANY—
A. O. Boniface, New York City.
FORD COLLIERIES COMPANY—
M. S. Murray, Curtisville, Pa.
GOLDEN AGE MINING COMPANY—
N. H. Cottrell, Denver, Colo.
HAWS REFRACTORIES COMPANY—
J. W. Miller, Johnstown, Pa.
HOMESTAKE MINING COMPANY—
Guy J. Johnson, Lead, S. D.
IRONTON ENGINE COMPANY—
W. H. Patton, Philadelphia.
KINGSTON COAL COMPANY—
E. L. Solomon, Kingston, Pa.
MASSACHUSETTS INSTITUTE OF TECHNOLOGY
C. H. Chadborn, Boston.
E. L. Johansen, Cambridge, Mass.
E. D. Martin, Boston.
MINE SAFETY APPLIANCES COMPANY—
J. T. Ryan, Pittsburgh.
NATIONAL ENAMELING COMPANY—
J. W. Costley, Granite City, Ill.
NATIONAL ENAMELING AND STAMPING COMPANY—
Phil Stremmel, St. Louis, Mo.
NEW ENGLAND TELEPHONE AND TELEGRAPH COMPANY—
H. A. McCoy, Boston.
NEW JERSEY DEPARTMENT OF LABOR—
L. Erskine, Trenton, N. J.

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New Jersey Zinc Company—
W. G. Bailey, Ogdensburg, N. J.
Edward R. Carboy, Franklin, N. J.
Frank Chandler, Ogdensburg, N. J.
J. C. Condon, Franklin, N. J.
Wm. Roberts, Ogdensburg, N. J.
R. H. Seip, Franklin, N. J.
Matthew Stephens, Franklin, N. J.
B. F. Tillson, Franklin, N. J.

Ocean Accident and Guarantee Company—
J. M. Hammerschlag, New York City.

Pennsylvania Department of Mines—
Richard Maize, Uniontown, Pa.

Pittsburgh Plate Glass Company—
D. P. Kennedy, Pittsburgh.

H. K. Porter Company—
C. B. Hodges, Pittsburgh.

Prudential Insurance Company—
Sylvester Schattschneider, Newark, N. J.

Rockhouse Coal Company—
Carel Robinson, Blackey, Ky.

Stuart, James and Cooke—
Charles E. Stuart, New York City.

Superior Coal Company—
D. D. Wilcox, Gillespie, Ill.

Susquehanna Collieries Company—
W. L. Jacobus, Wilkes-Barre, Pa.

The Texas Company—
A. G. Price, Providence, R. I.

United States Bureau of Mines—
F. J. Bailey, Washington, D. C.
Rudolf Kudlich, Washington, D. C.
Dr. R. R. Sayers, Washington, D. C.

United States Bureau of Mines, and National Safety Council—
C. L. Colburn, Pittsburgh.

SUMMARY OF REPRESENTATION AT MINING SECTION MEETINGS

Number of sessions	5
Total attendance at all sessions	176
Average attendance at each session	35
Total number of persons attending sessions	61
Number coal mining companies represented	8
Number metal mining companies represented	4
Number of other companies represented	22
Number of state or government departments represented	5
Number of countries represented	3
Number of state represented	15
Number of papers presented	21

TUESDAY MORNING SESSION

CHAIRMAN TILLSON presented in his annual report the history of the Mining Section; told of the volume of safety literature accumulated through its agency; spoke of the small annual dues in comparison to the large amount of service rendered; told of the added service received by mining members through co-operation with the United States Bureau of Mines, and told of the investigation being conducted by R. M. Raymond, in regard to standardizing hoisting ropes.

Dr. Raymond spoke briefly of the importance of the information he was accumulating, and asked the delegates to use their influence with their companies to the effect that his questionnaire should be completed and returned.

Chairman Tillson appointed the following nominating committee—C. W. Goodale, Chairman, Dr. R. M. Raymond, and J. W. Reed.

The meeting then took up a discussion of the subject, Underground Transport.

STORAGE BATTERY LOCOMOTIVES IN METAL MINES

E. V. Daveler, General Superintendent, and R. E. Renz, Chief Electrician, Butte and Superior Mining Company, Butte, Mont.

Use of storage battery locomotives for haulage in the metal mines of the west has increased steadily since 1913. The demand for more efficient, economical operations in underground haulage has resulted in operators

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giving serious consideration to this phase of mining operations. The different methods of haulage underground are hand tramming, mule tramming, trolley locomotive haulage and storage battery locomotive haulage. Hand and mule tramming will always have their own field when the tonnage from any one level is not sufficient to warrant the use of motor haulage. Trolley locomotive haulage is well suited to long hauls underground where there is a large tonnage and ample head-room in ground that is readily held in place. The storage battery has its particular field in that it can operate in drifts or haulage ways with a minimum of head-room, it has a wide range in amount that can be hauled, and can easily be moved from one level to another when mining operations demand it. It can fit into any of the particular fields of the three other common methods of underground haulage.

In the Butte and Superior Mining Company mine at Butte, underground haulage with storage battery locomotives has been very successful. The mine is being, or has been, operated down to the 2,300 foot level with mining operations being carried on from the 800 to the 2,300 foot level in the last nine years. The ore bodies are wide and the ground is very heavy, causing a continual shifting of the grade on the haulage levels and making it unfavorable to economically maintain a constant height of the haulage ways. Due to this condition all haulage ways are narrow and low.

In 1913 hand tramming, due to the grade variations in the levels, had become very inefficient. From a safety standpoint, trolley haulage was out of the question, because the drifts were too low and the ground was moving. It not only made a dangerous condition but also made a serious fire hazard. The upkeep on the trolley system under the mining conditions would be prohibitive. It was decided to try out the storage battery locomotive system, then in the experimental stage, and two Jeffrey storage battery locomotives were installed early in 1913, and two additional locomotives in 1914.

Following is a description of these locomotives:

Weight of chassis	2½ tons
Weight of chassis with battery	3½ tons
Gauge of rail	18 inches
Wheel base	36 inches
Length of locomotive	11 feet
Maximum width	32 inches
Draw bar pull	1500 lbs.

These locomotives were equipped with two sets of batteries, one to be used while the other was charging, giving continuous service for the locomotive. Each battery consisted of 63-A4 Edison cells having a capacity of 150 ampere hours at 75 volts. The locomotives were equipped with two motors, each geared to a separate set of drive wheels by means of worm gears in one reduction. With this construction it was possible to keep the maximum width down to 32 inches. The speed of the locomotive is 4 miles per hour. The control is standard series parallel control with resistance points between.

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SAFETY PROVISIONS

It was discovered that in wet levels the storage battery cells would ground, and that due to electrolysis the steel containers were eaten away, causing leakage. This was due to insufficient insulation between cell and battery box, which was remedied by mounting the individual cells on porcelain blocks. This method of insulation is still in use, although the Edison Company has devised a method of insulation by rubber bushings which is apparently as satisfactory.

Early in 1917 the work required of the locomotives became very heavy and it was necessary to change the A4 batteries before the shift was finished. These cells were then replaced with the A6 cells with a capacity of 225 ampere hours. The number of cells to a battery was increased from 63 to 66, and later to 72, which is the greatest K. W. capacity we can accommodate on our present motors. This has improved the efficiency of the locomotives materially, as the voltage at end of discharge holds up better, and greater loads at higher speeds can be handled. At the present time the company has nine locomotives, each equipped with two sets of batteries.

One big advantage of storage battery locomotives is almost entire freedom from electrical trouble such as grounds and shorts in armatures and field coils. Due to the voltage being only 75 to 80, there is very little danger from accidental contacts. During the entire operations at the Butte and Superior Mine there has been no accident of an electrical nature on the locomotives. As originally built, leads were connected to locomotives by means of terminal screws and there was always the possibility of the motorman burning himself when changing batteries, also the likelihood of not screwing up terminals, with consequent loss of power and eventual burning up of terminals. This has been changed by replacing with a plug type contact, doing away with all danger from burning and poor contact. Another bad feature was the danger of cover to battery box being jarred out of position and catching on timber posts, in which case the life of the motorman would be endangered. This happened in one case, but as the locomotive was traveling slowly the motorman shut off the power and escaped serious injury. This has been remedied by belting angle pieces on battery box so that the cover could be put on in one way only and was then held securely in place. As originally furnished, switches, fuses and instruments were mounted on a panel in front of the motorman. This has been changed, and all exposed parts enclosed in metal boxes of substantial construction. Due to small width of locomotives and drifts there was always danger of part of the motorman's body extending over the side of the locomotive and consequently danger of being caught on timbers and being badly hurt. To correct this, all locomotives are now equipped with a sheet iron guard so that motorman, intentionally or otherwise, cannot have part of his body extending over the side of the locomotive.

Locomotives are equipped with modern headlights with 94 watt focusing type lamps. All locomotives have foot bells, and as speed is slow few accidents occur.

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CARE OF THE LOCOMOTIVE

The locomotives furnished were not equipped with charging meters but we have equipped all locomotives with Sangamo ampere hour meters with compensation shunts which register ampere hour discharge, and on charge compensate for losses and measure proper charge, automatically cutting off charging current at the proper time. This helps materially in maintaining batteries in proper condition and reduces the consumption of distilled water. The most regular and careful inspection and attendance must be given the batteries. They should be regularly filled with distilled water; they must be kept free from moisture and dirt, and tops well covered with vaseline to keep salts from creeping and shorting terminals; batteries should be cleaned regularly and at periods of twelve to eighteen months; the old solution should be poured out and all sediment removed by washing with clean old solution; water should not be used for washing, as it removes deposits from the plates, which is detrimental.

The batteries after cleaning should be filled with new solution and discharged down to zero. Charge is then reversed and then charged up fully in proper direction. This will bring the cells back to nearly full capacity even if before they were falling considerably below capacity. In handling the solution great care should be taken as it is a 22 per cent solution of hydrate of potassium and is very corrosive, attacking the skin and eyes very severely. Rubber gloves and aprons should be worn, and goggles worn over the eyes when working with the solution. The average life of batteries is three years.

At the Butte and Superior plant one electrician cares for all the locomotives, making daily inspections. Charging is done on each level where locomotives are located, locomotive barns being equipped with charging panels, water filling equipment and chain block with crawls for changing batteries. The distilled water is made on the surface at a cost of less than one-half cent per gallon, and approximately twenty gallons are used per day for eighteen sets of batteries. The charging voltage varies from 125 to 135 volts and is supplied from smaller motor generator sets.

SERVICE OF LOCOMOTIVES

At the Butte and Superior plant the average length of haul is approximately 500 feet, varying from 200 to 3,000 feet. About ten cars are hauled per trip, the weight of ore and car being 2,250 lbs. The cars are equipped with roller bearings.

OPERATING COSTS

The cost of operation at the Butte and Superior plants have been above normal, for several reasons—poor grades; short hauls with small number of cars, and conditions in part of the mine which are not conducive to long life of battery.

For the year 1919 the Butte and Superior costs were as follows:

Number of locomotives operating	9
Cars of ore hauled	605,372

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Cars of waste hauled	132,415	
Average haul of car of ore	800 feet	
Average haul of car of waste	747 feet	
Cost of power per car hauled	$	.0041
Cost of repairs for locomotive per car hauled		.03205
Cost of motorman and helper per car hauled		.0690
Total		.10515

Although batteries are guaranteed for four years, this life has been greatly exceeded.

From a safety standpoint the storage battery locomotive is probably the most satisfactory of all power haulage underground, and its wide range of application will make it highly favored in new installations.

ADVANTAGES OF TROLLEY LOCOMOTIVES FOR UNDERGROUND HAULAGE FROM A SAFETY STANDPOINT

FREDERICK W. WHITESIDE, CHIEF ENGINEER, THE VICTOR-AMERICAN FUEL COMPANY, DENVER, COLO.

Underground mine haulage is usually considered under two principal headings—animal and mechanical. The former may still be further subdivided into, man, mule, horse, and burro haulage; the latter into rope, compressed air, steam, gas engine, and electric (storage battery, reel and trolley) haulage.

Animal haulage is always dangerous, especially in wet mines and upon steep grades. Where the mine floor is wet and composed of shale, or clay, the animal's feet soon excavate deep holes between the ties which offer a constant opportunity to trip and throw him in front of a loaded car. It is true that this condition can be improved, or even eliminated, by grading and ballasting with gravel, broken rock, or cinders and by excavating proper drainage ditches along the sides, but this is seldom done. The presence of deep pitfalls between the ties makes traveling more dangerous for the men themselves.

On grades exceeding 2 per cent, animal haulage is not only unsafe, but inefficient. I have known of cases where a mule gathering cars upon steep grades would become so exhausted by 3 o'clock in the afternoon, that he would be unable to keep ahead of a swiftly moving mine trip descending a grade and would attempt to turn into a cross cut to get out of the way, killing the animal and wrecking the trip. Also, as an animal becomes fatigued, he slows down. His afternoon's performance therefore never equals that of the morning.

There is also a tendency toward promoting carelessness in maintaining the proper roof height. A motor of iron, copper, and steel requires fixed overhead and side clearance in order to pass. I saw quite recently an entry in which the roof was so low the top of the pit cars would barely clear. These cars were drawn by a mule whose withers were fifteen inches higher still. How the animal could travel four or five miles an

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hour and avoid roofing is a problem. Had an electric trolley locomotive been operating in this place, ample height of roof would have had to be maintained to support the trolley wire at the correct elevation above the rail.

It may be argued that animal haulage is very often necessary for gathering, but it is nearly always possible to design a mining operation so that this objectionable feature is eliminated.

In cases of grades steeper than 4 per cent the traction locomotive drops out of the race as rope haulage is then more efficient. A rope is often a source of danger in a haulage-way, especially if there are curves in the alignment and sags in the grade. The side sheaves and rope rollers afford frequent opportunities to trip the men working about the pit trains and have caused many sprained ankles and broken legs.

Compressed air locomotives are still used in some underground operations. Due to low efficiency and the inconvenience and delay incident to recharging, they have not met with widespread popularity. Their center of gravity being high, they are more trying to track, and derail more easily than the electric engine with its low center of gravity. If overcharged, danger is present, as a weak seam may cause a severe explosion, injuring one or more of the crew and perchance setting sufficient explosive coal dust in motion to cause a disastrous mine explosion, should any open lights be about.

I am not advised as to whether or not there are any steam underground locomotives or dinkeys in use, but I am inclined to believe not. However, should the attempt be made to operate steam driven engines underground, many evils to roof and ventilation would result. The writer has found a number of operators who claim to prefer the dinkey to the electric locomotive for outside haulage. Like the compressed air motor, its center of gravity is higher than the electric machine, making it much more severe upon track. It may become a source of danger should the boiler explode.

The gasoline locomotive has not been successful for underground haulage, as its exhaust carries such a high percentage of CO, CO_2, and other products of incomplete combustion, that the mine ventilation is seriously impaired and men working in its immediate vicinity are sometimes overcome and made seriously ill. It requires no bonding of rails, no trolley wire and no "juice", simply oil, gasoline and water. It can go anywhere track is laid—yet its habit of contaminating the air is so serious that for underground operations, the gasoline locomotive has found its way into the discard.

The storage battery locomotive possesses all the advantages of the gas engine without the latter's most serious defect, namely, that of polluting the mine air. But it is not adapted for long, hard hauls or long, continuous and uninterrupted service. The battery is its weakest part. So far as safety is concerned, I see but little difference between the storage battery and the trolley locomotive. Possibly the odds are slightly in favor of the former, as it is independent of the trolley and trolley wire.

Like the storage battery motor, the cable reel locomotive's great advantage lies in the fact that it can travel upon unbonded track and

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without a trolley wire. Considerable difficulty has always been experienced in handling the power wire as the winding reel is neither very positive nor automatic in operation. The locomotive occasionally runs over the wire cutting it in two and producing an elaborate display of fireworks, which with favorable conditions of CH_4 and dry coal dust may cause a serious mine explosion. There is always the chance of the occurrence of worn spots in the insulation of the power cable which is dangerous.

We have now arrived at the subject of this paper, "Advantages of the Trolley Locomotive from a Safety Standpoint." It is but fair, in this type of installation, as well as any of the others which have been heretofore enumerated, to insist that it be properly installed. The rails in the track must be of ample weight to carry the load and to hold their alignment with a minimum amount of attention. The rails must be well bonded and the bonding afterward frequently tested. The current in the trolley wire must be kept up to standard voltage by a feed wire of ample capacity, and the trolley wire itself must be securely supported and anchored at a height or not less than six feet six inches above the top of the rail. Sharp vertical angles in the trolley wire and rough riding trolley frogs must be avoided, as such irregularities cause sparking with its attendant danger in a gas laden atmosphere. Wherever men pass under the trolley wire it should be protected with shields constructed of wood or some other non-conducting material. While a great many mines operate their trolley lines at 500 volts pressure, the writer feels strongly in favor of half that amount for DC current, both for haulage and power motors. One hundred and twenty-five volts of electric current will cause death under the proper conditions of moisture and contact. It would therefore seem that double that amount should be as heavy a potential as should be carried in exposed and uninsulated underground electric wires. For pump, fan and similar motors, 440 AC or 500 DC can be safely used.

Assuming that the track bonding, trolley wire, and feed wires have all been correctly installed, there then remains but little to be done to insure a safe and efficient mine haulage operation. The feed wire must be supplied with electric current of proper potential and the motor with mine cars of sufficient number.

The latest types of trolley haulage motors are equipped with dynamic brakes which add greatly to their ease of control and to their safety of operation. Few pieces of machinery about the mine require as little care as a good electric haulage locomotive. This fact adds greatly to the safety of its operation. A machine which the driver knows can always be depended upon to do a certain amount of work, to make a certain pull with a given number of cars, to descend a certain hill safely with a known number of loads, presents a generous factor of safety.

The conditions above set forth apply to the average mine property. There undoubtedly exist certain operations which require special treatment and special equipment, and to which some, at least, of the above statements cannot be made to apply. It appears to the writer that the essential safety features of the electric haulage locomotive lie in its reliability under unusual and adverse conditions, its ease of control, and its ability to "deliver the goods" whenever required.

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COMPRESSED AIR HAULAGE

GUY J. JOHNSON, SAFETY ENGINEER, HOMESTAKE MINING COMPANY, LEAD, S. D.

Underground compressed air haulage was started at the Homestake in 1904, and by 1908 had completely supplanted animal haulage. Our high pressure compressor installation consists of an Ingersoll Sergeant four stage, cross compound Corliss, converted from steam to electric driven (Dodge rope drive), with a piston displacement of 2,060 cubic feet per minute, rated to deliver air under 900 pounds pressure at a 5,000 foot elevation; and one Fraser and Chalmers steam end—Ingersoll Rand air end, four stage, cross compound Corliss, with a piston displacement of 860 cubic feet per minute—rated to deliver air under 900 pounds pressure at a 5,000 foot elevation. This latter mentioned unit is used only as a standby.

On the surface, to deliver ore to the five mills, we have one fourteen ton locomotive, with 9x14-inch cylinders and a 165 cubic foot air capacity, and two eight and one-half ton locomotives with 7x12-inch cylinders and 70 cubic foot air capacity. These operate on 22-inch gauge tracks, and haul bottom dump cars of 77½ cubic foot capacity.

Underground, we are operating on fifteen levels, with thirty locomotives, over approximately sixty miles of 18-inch gauge track, using both end and side dump cars of 19 cubic foot capacity. Of these locomotives, seventeen are five ton, with 6x10-inch cylinders and forty cubic foot air capacity; three are five ton with 6x10-inch cylinders and 28½ cubic foot air capacity; and ten are three and one-half ton, with 5x8-inch cylinders and 20½ cubic foot air capacity. All receive their air charges at approximately 800 pounds, and deliver it to their cylinders at 150 pounds. Their "cruising radius" is two thousand feet with full load, and return. Their charging period is less than a minute, so they can operate continuously without more than the normal stop at the end of each haul.

In spite of the very evident mechanical losses in compressing air above 800 pounds and using it at 150 pounds, our power cost is .0211 (two and one-tenth cents) per ton mile. (With the addition of an Ingersoll Rand PRE type compressor, and using present steam compressor as a governing unit, we expect to cut this to .013) or .00916 (nine-tenths of a cent) per ton—charging power at .00836 per K.W.—this figure including interest and depreciation on the construction costs of our four power plants.

Our maintenance and repair of compressors, locomotives, pipe lines, charging stations and so forth, costs .0177 per ton mile, or .00768 per ton. One man keeps up all high pressure pipe lines and charging stations. The locomotives are very sturdy and simple, and therefore are seldom in the shops. For instance, a set of tires will run three years, due, in part, to using water instead of sand for proper traction. This water is fed from tanks of about four gallon capacity, through petcocks, directly to the tops of the drive wheels.

As most of the charging stations are located near shaft stations, our haulage ways and chutes are not much complicated by high pressure pipe lines. The necessary amount of piping is hung in one corner of

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the back of the drifts, quite out of the way, and its only maintenance cost is an occasional painting.

Maintaining sixty odd miles of trolley lines throughout our workings would be a very strenuous proposition, as a great deal of this mileage would be through timber, working ground, or past chutes, thus being a fire hazard, besides being a direct hazard to the men, particularly in wet sections. Practically all this installation antedates the perfection of storage battery motors, and even now, we doubt if their lower power consumption will more than balance the above maintenance and repair costs.

During seventeen years of using compressed air for underground haulage, we have had but one serious injury chargeable to transmission lines. This one injury occurred early in the game, when the high pressure pipes were buried along the sides of the drifts. A miner, noticing an air leak, started to investigate it with the point of his candlestick. This suddenly increased the size of the leak, and he was blown away with enough force to break his leg. During this same period, over 25,000,000 tons of ore have been hauled, not to mention the millions of tons of waste and timber.

STORAGE BATTERY LOCOMOTIVES

The subject of storage battery locomotives in mine haulage was then presented by Mr. Charles E. Stuart, of New York City. Particular mention was made of the constant demand of the storage locomotive as compared with the spasmodic and high peak load demands of the trolley or reel type locomotives. Although the actual over-all efficiency of the reel type locomotive is greater than that of the storage battery this advantage is completely discounted by the voltage loss between the substations and power plant, and Mr. Stuart discounts the advantage of either type over the other where the question of efficiency is concerned. A number of interesting charts were shown, giving the performance of the several types of electric locomotives under the varying conditions.

Mr. Stuart considered the subject more from an economic than from a safety standpoint, and for that reason the paper has been given to the American Institute of Mining and Metallurgical Engineers for publication in its transactions.

DISCUSSION

Mr. Stuart asked why haulage was so expensive in metal mines; he thought that the metal mining haulage costs should be less than coal mining haulage costs, but said that Mr. Rosenblat (meeting San Francisco Section A. I. M. E., April, 1921) stated that the cost ran from 35 to 75 cents per ton mile. Mr. Stuart estimated the haulage costs per ton mile for one metal mine at about 50 per cent of the cost under similar conditions in a coal mine. That cost was only a fraction of what was indicated by Mr. Rosenblat.

Mr. Tillson stated that the mining method and volume of tonnage influenced costs, but that the question of costs is chiefly a state of mind anyway, there being quite a diversion of opinion as to what items should be included. In coal mining, the loading of the car does not enter into

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the haulage cost, while in metal mines the loading is usually charged in as a part of the transportation cost. The haul in metal mines is usually less than that of coal mines, and the tonnage is not as great. At the New Jersey Zinc Mine, Franklin, N. J., the average haul was about 1,000 feet, and the cost was approximately 2 cents per ton or 11 cents per ton mile. This figure was for 1913.

Mr. Guy Johnson stated that at the Homestake Mine, operating on from five to ten levels, and where the labor cost of haulage is high, the total cost per ton mile is about 14 cents.

Mr. Rudolph Kudlich, U. S. Bureau of Mines, Washington, D. C., stated that the cost of hauling in a metal mine depends largely upon the amount of hand tramming done.

Mr. Charles W. Goodale, Anaconda Copper Mining Company, stated that in metal mines a great amount of time is lost in loading the cars. In coal mines the cars have already been loaded, and it is only necessary for the locomotive to hook on to the trip and move out.

Mr. Stuart stated that in a well developed coal mine the average haul would be three-quarters of a mile or more, whereas in a metal mine the drifts are seldom longer than 2,000 feet.

Mr. Tillson said that the cars in metal mines are usually small in comparison to those in coal mines. In many metal mines a track gauge of only 18 inches is used, while in coal mines the majority of gauges are 40 inches or more.

Mr. W. H. Patton, of the Ironton Engine Company, Philadelphia, stated that in one metal mine they were using a 24-inch gauge track, and the electric locomotive had an overall width of 42 inches, and he believed that it would have been far better to have used a gauge of 36 inches or 40 inches.

Mr. Tillson brought out that in metal mines the cars are very often pushed by hand and it is difficult for one man to push a broad-gauge heavy car. It is also hard to push a broad-gauge car around curves.

Mr. Patton said that the width of gauge makes much difference in the amount of labor necessary to tram by hand. The width of gauge influences the radius of a curve. A man would have difficulty in pushing a 36-inch gauge car around a curve.

Mr. J. W. Reed, Safety Engineer of the Consolidation Coal Company, Fairmont, W. Va., stated that increasing the size and width of cars in coal mines greatly increases the number of accidents and serious injuries. Wider cars mean, necessarily, wider entrances, because under some state laws a certain amount of clearance must be left. If cars are to be handled altogether by machinery, larger cars can be used, but a man cannot handle a large car in a room by hand without getting hurt. Very often it is necessary to place props close to the track to support the roof, and men often get their fingers crushed between the car and posts. A large car is harder to handle on a grade, and in cases of derailment, men injure themselves trying to get the car back on the track.

Mr. Carel Robinson, The Rockland Coal Company, Blackey, Ky., thought that the size of car depended upon the mining conditions, that in a great number of mines the large car would increase the accident hazard, but

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under general conditions the large capacity car would be safer, because the train could move slower and still get out the required amount of tonnage.

Mr. D. D. Wilcox, Superior Coal Company, Gillespie, Ill., said that his experience has shown that the large car is the safe car. It is necessary to build and maintain a heavy track for large cars. The trouble is due to attempting to use large cars on light track. Where cars are larger, better equipment is used, and more care is taken in keeping up the equipment.

Mr. Johnson stated that coal miners are not acquainted with the heavy ground conditions found in metal mines, where 14-inch to 20-inch posts have been crushed; that it is very expensive to keep up large drifts in heavy ground, therefore it is necessary for the metal miner to use small cars to be able to run in small drifts.

Mr. E. L. Solomon, Kingston Coal Company, Kingston, Pa., observed that no matter what the size of the car, the conditions encountered in the mine and the human equation have much to do with the cause of accidents, and that instructions should be given to the miners on how to handle the cars with which they are working.

ADJOURNMENT.

TUESDAY AFTERNOON SESSION

THE second session was devoted to a continuation of the discussion of underground transportation.

Owing to the absence of Mr. Tillson, D. E. A. Charlton, chairman of the program committee, presided.

ANIMAL HAULAGE AT ANTHRACITE COAL MINES

E. L. Solomon, Kingston Coal Company, Kingston, Pa.

(Before presenting his paper, Mr. Solomon outlined briefly the safety organization of the Kingston Coal Company. This organization consists of a committee of workmen in each vein or seam in each shaft. Monthly meetings of this committee are held, and the committee reports to a safety committee composed of the foremen in that shaft. Each foreman in turn acts as chairman of this committee for one month. The findings of this committee are sent to the general safety committee, consisting of the general manager and his staff, for final disposition.)

Animal haulage is of paramount importance in anthracite mines. A variety of problems is involved, the most difficult of which is the safety of men and animals engaged. The majority of men in transportation are for the greater part of the time performing their duties without the personal supervision of transportation officials, and it is therefore necessary to provide equipment and appliances that will reduce the possibility of accidents to a minimum, and prevent chance taking.

Beginning at the face or chamber, the car to be loaded should be se-

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curely blocked to prevent it being bumped into the face or starting out by accident before or during loading. The safety block or device used should be one that cannot be easily dislodged accidentally by men or mules during loading, and yet permit removal without undue effort after the car is loaded (see Figure I). Sprags are unsafe and should not be used to hold a car at the face.

In removing a car from the chamber, if mules are used for gathering, the safe method is to use a steel shaft and gun (see Figure I). Such equipment permits the mule to control the car, gives him confidence, and reduces nervousness. One mule equipped with steel shaft and gun under similar conditions will ordinarily do the work of two mules equipped with trace chains

FIGURE I. STEEL SHAFT AND GUN ATTACHED TO CAR; ALSO BLOCKS

and spreader. A team of mules hauling cars with trace chains have no control of the cars. No wonder they are nervous and kick—the lead mule cannot see the road, the breeching mule is bumped by the car every time there is a change of grade. The trace chains rub his flank in the same spot every day and it is sore. Equip one of the mules with a shaft and gun, hang a light on his collar, and his control of the car is the same as a horse hitched to a single wagon; nothing rubs his flanks, going down grade he holds the car back. The driver rides the car in perfect safety, the mule cannot kick him. The driver's light shows the road ahead. If at the gangway an empty car has been left standing, the steel shaft comes in contact with the car and is bent; send it to the shop and have it straightened, the mule is not injured. What would have happened to the mule hauling a car with trace chains. He would have been either killed or badly injured. The driver's position on the car makes it possible to light the road ahead.

If trace chains are used make the spreader stick long enough to prevent the trace chain rubbing the mules' flank and a few inches longer than the track gauge to prevent it being caught between the rails.

MAINTENANCE OF WAY IMPORTANT

Main roads should be properly graded, rails securely spiked, track gauge maintained, splice bars attached and made secure. Loose splice

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bars cause many derailments and consequent injury to transportation employees and animals. Provide all branches with derails to protect the gangway and chamber face. Install head blocks on all slopes. Levers to operate switches and head blocks should be so arranged that jarring of passing trips will not open them. Install safety holes for switch levers; that method not only removes an obstruction from the animals' paths, but provides a safe place to operate the lever. Provide sufficient space on all roads between cars and rib or wall to permit transportation employees to perform their duties in safety. Flat wheels and loose bearings cause derailments and consequent injury to animals. Provide all trips with a light and suitable alarm that can be heard some distance away. See that they are used at all times. Couplings, chains, and cones should be frequently annealed in a wood fire; after annealing thoroughly inspect them for defects. Teach drivers a standard system of commands. Can all of us understand five or six different languages? How do you suppose an animal is to understand them?

Entrances to shafts or slopes not in use should be fenced across the width of such entrance to prevent men and animals from entering. Provide a separate safe travel way so that animals do not go to and from work on slopes and main haulage roads. If it is necessary to use main roads or slopes for animals to go to and from their work, do that before and after working hours or stop haulage during the time animals are going in and coming out.

FIGURE II. CONCRETE BATH TUB FOR MULES.

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DRINKS AND BATHS FOR MULES

Keep a sufficient number of car wheel blocks on hand at passing branches, foot of slopes, and other important places to stop trips and cars. Provide fresh water for animals to drink during the day, by piping or by using a tank car. If the animals do not return to the barn at noon time, they should be fed at that time. Build a bath tub near the barn (see Figure II), make arrangements to temper the water, and as each mule returns from his day's work, teach him to walk through the water. The dust, mud and sulphur water will be washed from his legs; he will feel, work and look better.

In the anthracite field the majority of veins are worked through shafts and heavy pitch slopes. These conditions make it necessary to construct fireproof barns in the mines to house these animals (see Figure III). In the

FIGURE III. CONCRETE BARN 700 FEET BELOW SURFACE.

majority of cases the housing conditions in anthracite mines are safe, clean, and well ventilated. One feature very necessary for the health and life of mules engaged in mine transportation has been almost entirely overlooked, that is—recreation. Because of the fact that it is not practical to remove mules from the mines daily (unless injured), the mine mule seldom if ever comes to the surface, but spends the balance of his life underground. In order to prolong the mule's life it is necessary to provide recreation of some sort. That which seems to appeal to the mule is the barnyard. Did you ever watch them run, roll, jump and kick when liberated in a barnyard? Provide an opening at the end of the mine barn free from props, as wide as possible, and about one hundred feet long, import clay from the surface, cover the bottom about twelve inches deep, build a fence across the width at both ends, provide a suitable gate at the barn end,

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turn a number of mules loose in the barnyard daily, idle days, or Sundays, and you will not only note the improvement in their condition, but find in them a willingness to do more work.

If the suggestions contained in this paper are complied with, animal transportation will be improved 100 per cent and safety well guarded.

ANIMAL HAULAGE IN COAL MINES

R. M. MAGRAW, GENERAL SUPERINTENDENT, UNITED STATES FUEL COMPANY, HIAWATHA, UTAH.

The horse, and his hybrid cousin, the mule, are fast being supplanted in most industries by mechanical appliances, which, if not actually safer, at least have the saving virtue of greater efficiency or economy. Animal haulage in coal mines superseded man-power at an early date, and undoubtedly effected a wonderful increase in efficiency, and improved the general health and vitality of the human workers who had previously been engaged in the arduous task of transporting the coal from the working faces to the shaft bottom or to the surface.

It is probably true that the advent of the first animal underground met with as much opposition and skepticism as that usually shown by the average mine worker of today when he is confronted by any innovation or new piece of mining machinery. Notwithstanding objections, however, animal haulage became quite general and while various types of mechanical appliances have from time to time been adopted, either for their greater efficiency or safety, still, under certain circumstances and conditions, animal haulage may be not only efficient, but as safe, or safer, than mechanical methods.

SELECTION AND CARE OF ANIMALS

Horses and mules are quite generally used in coal mines as motive power, but in some mines where the height is limited, ponies of either the Shetland or Orkney breeds, are preferred. Small mules or Jennets are also used in many of the low seam mines.

Many operators favor mules as against horses or ponies for coal mine work, claiming that they are hardier, capable of standing more abuse, cheaper to feed, and easier to break to mine work. Granting most of the contentions without argument, the writer favors the horse or pony, as a somewhat hectic career as a skinner in early youth convinced him that all other good points to the contrary notwithstanding, the mule is generally a dangerous, and at times a bloodthirsty animal. Like other hybrids or mongrels, the mule shows all of the meanness of both ancestral races, without developing the good points of either. From a safety standpoint, alone, the mule should therefore be looked upon with suspicion.

The horse, on the other hand, is usually docile if properly handled, and inspires a genuine liking from the average driver, and while it is granted that he cannot stand the abuse that the mule can, still there should be

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no occasion for abuse; so why put up with the mean temper of the average mine mule?

Animals for mine use, either horses, ponies, or mules, should be selected with a great deal of care; as to age, four to six years; disposition, gentle; weight, governed by work to be performed; height; governed by thickness of seam or total height of entries resulting from brushing.

A good head, thick chest, long barrel, with short legs, without thick hocks or unduly large feet is considered as the best type of mine animal. Money can generally be saved, and the safety of employees who will eventually handle the stock can be insured, by the employment of a competent veterinary surgeon to select animals to be purchased.

Clean, comfortable, well ventilated and well lighted stables should always be provided for mine stock, and where it is possible to do so, such stables should be located above ground. The ration should be governed by the weight of the animals, and the nature of the work being performed. Only the best hay and grain should be used. It is fallacious, as well as inhuman, to believe that any economy results from feeding spoiled or second grade feed.

Where mines are unavoidably muddy, wash-racks should be provided at or near the stables, where the legs of animals can be washed off with a hose. This keeps them from getting sore legs, which, if allowed to exist, eventually cause animals to develop mean dispositions, with consequent danger to drivers and others.

Harness should be inspected daily, and necessary repairs made whenever any part is worn, as danger to the driver or other employees may result from the breaking of worn harness in service, as well as danger and discomfort to the horse or mule.

The collar is the most important part of the harness. It should be fitted carefully, and due care should be taken to see that it, as well as the horse's shoulders, are kept clean in order to avoid sore shoulders. If reasonable care is taken, sores can be practically eliminated, with greater comfort to the animals and safety to the human employees, as a mule or horse with sore back or shoulders is apt to display a meaner disposition than one that is well kept.

Each driver should have an animal allotted to him, and unless some very good reason exists, no change should be made during his term of service, as many accidents are directly traceable to the practice of shifting drivers from one animal to another. The same rule should apply to the territory from which the driver and horse are hauling coal, as the chances for accidents are increased whenever a driver enters a new territory with which he, and possibly the horse, is unacquainted.

Animals broken to work outside usually make the best for mine use, and where possible, only well broken animals should be purchased, as they will be found to be cheaper and safer in the long run. Some animals require very little additional breaking for underground work, while others never do become accustomed to the noises, darkness, etc., of the mines. It is dangerous to keep such animals, as they are likely at any time to cause injury to human employees.

A good rule to follow when breaking new stock is to take the animal

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into the mine, fully harnessed, and tie him securely in a crosscut near a busy, well lighted parting, where he can see and hear all that is going on. After a day, or more if he is particularly nervous, he should be given to a careful driver and used to haul empty cars on an easy run. If the animal is fractious it is sometimes advantageous to furnish the driver with a helper for a short time. After a day or two at this work he is generally ready to take his turn with the other animals in the mine.

Natural conditions in the mines, together with personal preferences of the operating officials, usually determine the type of harness and car connection used. In districts where light grades prevail, the butt-stick or spreader with tail chain usually is seen. From a safety standpoint the butt-stick is preferable to the spreader. In Utah, and in other sections of the Rocky Mountain district, where grades are heavy and frequently irregular, the use of shafts is quite general. The shafts are heavy and cumbersome, and add very materially to the load of the horse or mule, but it is the belief of most operating officials that they increase the safety of both animal and driver, in that they permit the horse to hold back on grades and thus control the car, which otherwise would endanger not only the animal, but human employees as well, for cars will frequently run wild on steep grades, although all four wheels may be securely spragged or controlled by brakes.

SPRAGS VS. BRAKES

A justifiable difference of opinion exists as to the relative merits of the sprag and the single or double brake as a means of controlling mine cars. In the writer's opinion, formed after years of experience with both brakes and sprags, both methods are entitled to their day in court. Where grades are light or practically non-existent, as in some of the eastern mines, the brake is more efficient, and probably from a safety standpoint more desirable than the sprags; but in mines where grades of from 5 to 10 per cent are the rule, with frequent reversals of pitch, the sprag is the safest, as it can be seen that a brake failure would leave the car without any control, but where four wheels are spragged, the failure of one or more sprags would still leave partial control. Many years ago in a West Virginia mine, where the writer worked, abnormal grades existed, and the cars were all equipped with excellent brakes capable, when in good order, of locking all four wheels, but the drivers insisted, for their own protection, that the company furnish them with sprags as an additional safeguard.

Where brakes are used they should be frequently inspected and adjusted or repaired as the occasion requires. Where sprags are used, only clean straight round hard wood should be furnished. The use of metal sprags, except on tipples, where men do not ride cars, should be discouraged, as the tendency of metal sprags to slip out, due to slight changes in grade or to low joints, is a well established fact.

MINE CARS

In designing a type of mine car for a new operation, unfortunately the safety of employees is seldom considered, not from any callous feeling on

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the subject, but usually as a result of oversight or ignorance. Many operators buy mine cars on the same principle that they buy rails—they get in touch with a manufacturer and order so many mine cars of a certain capacity and leave the details to the factory. In other cases a careful design is gotten up, based solely on economy and efficiency. Both methods are wrong, as unless the safety of employees is considered, the car which is most economical in first cost and upkeep and which will deliver the greatest tonnage to the tipple in a given time, may, through contributing to personal injuries, be the most expensive in the long run. Care should therefore be exercised in selecting a type of car to see that there is ample clearance between the top of the car and the normal roof of the mine to avoid injuries to the arms and heads of drivers and trip riders. Long bolt ends should not be permitted either inside or outside of a car. Where the roller type of end gate is in use, the end of roller and cotter key should not project beyond the side line of car. Safety hooks should be as short as possible and placed close to the bottom of the car in preference to being placed near the top, and in no case should they be pointed, as pointed hooks have a tendency to straighten out and become dangerous to men and animals. The bumper should be designed so as to give ample room for driver or trip rider, and the overall width of car should not be so great as to prevent the maintenance of proper clearance between the car and the ribs or timbers.

TRACKS

Many personal injuries accredited to other causes, such as, mine cars, falls of roof, or rib, etc., are directly attributable to bad track or to avoidable or unnecessary grades. Adverse grades resulting from small swamps or rolls can usually be corrected without prohibitive expense, and if the added safety to employees and haulage equipment is eliminated altogether, the resultant economy in haulage will more than return the investment with large interest.

Bad track in a modern coal mine is indefensible, morally as well as economically, as it is not only expensive but dangerous. This holds good whether the haulage be mechanical or animal, or a combination of the two. Anyone who has ever been privileged to overhear the language used by a bunch of drivers re-railing a car in a mud hole can vouch for the moral obliquity of bad track, and those who have kept accurate cost records can speak for the economic side. Rail too light for the load, insufficient ties, lack of angle bars or fish plates, lack of ballast, and poor switches are some of the shortcomings of mine tracks. In some cases, however, the rail is of proper weight, ties and fish plates are furnished in ample quantity, and switches are properly designed, but still the tracks are inferior. In such cases ignorance or carelessness is to blame.

Treatises on track laying are obtainable, which if followed only in part, will give reasonably satisfactory results, both as to safety and economy. A few general rules only, based on safety, will therefore be given.

Weight of rail should be great enough to carry the maximum load contemplated without surface bending. Ties should be spaced regularly,

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according to a definite standard. For most mine tracks 18 inch centers is a safe standard.

All joints should be connected with two fish plates or angle bars, to be fastened with not less than two bolts in each rail.

Spikes should be so spaced as to prevent movement of ties. Sketch showing proper and improper method of spacing spikes should be posted on the mine bulletin board, and a copy of same furnished to all track-layers. When necessary to join rails of different sections, offset fish plates or angle bars should be used in order to insure an even surface.

A rail bender, or Jim Crow, should be used to curve all rails. Do not spring to curve, as eventually track will spread and cause an accident which may result in serious personal injury.

All frogs should be securely riveted to heavy plates. All switch points should be planed true with base chamfered to fit snugly against main rail. Switch points should be connected by bridle rods, and where a switch stand is necessary the ground throw type is preferable.

Standard curves of as long radius as conditions will permit, consistent with good practice, should be adopted for the various types of turnouts, and switches calculated for these curves should be furnished as required.

Permanent track should be kept back 300 to 500 feet from entry fences, and before laying permanent track a profile should be made by a competent engineer, upon which the management should indicate the desired grade changes. Grade lines or points should then be established underground by the engineer and the entry graded before permanent track is laid. This system makes it possible to cut out swamps, low places in roof, etc., with the attendant danger to men and animals, without prohibitive expense.

CLEARANCE

Many accidents are caused to drivers and to other classes of employees by being rolled between moving cars and the rib or timbers. Proper clearance is therefore a desideratum which should not be overlooked. Wherever natural conditions will permit, the clearance on both sides of the track should be sufficient to permit a man to stand with safety between the rib and moving cars.

On side tracks or partings, space enough should be maintained between loaded and empty tracks, when occupied by cars, to clear a horse, and if possible the space between cars and ribs should be great enough to clear a man.

Where trolley wires, or other unprotected electric wires cross or traverse any haulage way or side track, they should either be 7½ feet clear of the rail, or protected by approved non-conducting troughs.

Where timbers or props are used they should be set far enough from the rail to clear a man alongside of a loaded car.

GENERAL

Where electric power is available, side tracks should be well lighted and lights should be installed at the top and bottom of all steep grades where the drivers are required to manipulate brakes or sprags.

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Tracks should be well ballasted with fine material which will stay in place, and holes due to wear should be filled as occasion demands.

Where a ditch crosses a haulage road, it should either be piped or substantially boxed.

The angles of all frogs and guard rails should be blocked with wood, or, what is better in most cases, with clay to which a little salt has been added.

Coal or other loose material should not be allowed to accumulate on tracks, or alongside of roadways. A little attention to track cleaning will not only net a profit from the coal savaged but the increase in production, due to clean haulageways, will be noticed as well, to say nothing of the added safety to men and animals.

Whitewash applied by a hand or power spray pump to roof and ribs increases the illumination immeasurably, and costs very little. A few years ago the average on quite an extensive area was sixty-six cents per thousand square feet.

Roof and ribs should be inspected regularly by competent men, and all loose material either propped or pulled down.

In mines where both mechanical and animal haulage are in vogue, the latter method is usually applied to gathering from development or other isolated areas of small production. It is therefore good practice to replace the animal haulage by mechanical appliances as soon as the tonnage produced by any district reaches a predetermined maximum, which can readily be calculated for any given mine by those familiar with the elements entering into cost of production. Mines using animal haulage entirely are usually small producers, where the demand is irregular and the return from the investment insufficient to warrant the cost of mechanical equipment.

THE DRIVERS

We have considered the type of animal best suited to mine use, his equipment and treatment, also the working conditions which, from the viewpoint of safety and efficiency, should surround him, while he is employed underground, but the paper would not be complete without a word as to the human element entering into animal haulage, namely, the driver or skinner.

If the average operating official used as much care in selecting his drivers as he does in the selection of his live stock, there would be fewer accidents, also more coal would be hauled in the mine.

A driver should be active, neither an inexperienced boy nor an old man; sober, if not an ardent subscriber to the Volstead act, and by all means humane, if not a lover of animals. Intelligence, honesty, industry and a love of self, coupled with a decent respect for the rights of others, are qualifications which are also desirable, and which are possessed by a large majority of the human race, so there should be no particular difficulty in selecting a bunch of drivers who would in the aggregate possess a modicum of the essential qualifications.

Proper supervision through the medium of intelligent and careful offi-

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cials is another means of reducing accidents. If an employee persists in taking chances it is better to dispense with his services.

THE ULTIMATE OUTCOME

It appears that the horse and his kind are doomed, like the dodo and the auk, to extinction, but it will be many years before mechanical haulage finally displaces animal haulage in all of the coal mines in the world.

From the standpoint of safety, mechanical haulage, with its greater efficiency and consequent elimination of employees, can be considered preferable, as, given conditions of equal safety, the number of accidents would seem to be in direct proportion to the number of employees, hence any reduction of employees in a given mine should result in a reduction in the accident rate.

Judging from the progress made in the past twenty-five years along mechanical lines, it is hardly too much to expect that the next decade or two will hold in store many improvements undreamed of today, and it may not be out of place to prophesy that at the end of twenty years at least 75 per cent of the coal produced in America will be hauled by mechanical methods from the working face to the tipple.

DISCUSSION

In answer to a question on how many cars a mule will average a day, Mr. Solomon stated that one storage battery locomotive in one of their mines displaced 19 mules that had been handling 150 cars a day.

Col. J. A. Ritson, Department of Mines, London, England, stated that the majority of the mining in England is done at 3,000 foot depths, where it is practically impossible to maintain a road of heighth sufficient to run a car containing more than one long ton. The roof is constantly settling, and the roadways are not more than 6 feet wide. The haulage is done by hand or by the use of Shetland ponies of from 36 to 40 inches in height. The ponies go in the dark and wear blinders to protect their eyes.

Mr. Solomon stated that mules as a rule give good service, and where they are balky it is on account of improper handling.

Col. Ritson asked why salt was added to the clay used in filling spaces in frogs. Mr. Solomon answered that it makes the clay of more assistance as a binder. Mr. Kudlich stated that the salt is added to keep it moist and in place.

BLOCK SIGNAL AND DESPATCHING SYSTEMS IN METAL MINES

R. T. Murrill, Safety Engineer, Inspiration Consolidated Copper Company, Inspiration, Ariz.

Block signal and despatcher systems have been in use in various forms on surface railways for many years, but only in comparatively recent years have they been applied to underground mining conditions.

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Surface block signaling has been done largely by means of semaphores, while underground conditions require the use of light signals. The application to mining conditions has been somewhat slow; lights have been used as station signals and in a few other forms, but block signals are comparatively new on the haulage levels. The introduction has been necessitated by the growth of the mines, the handling of large tonnages of ore, and the advent of motor haulage.

Not many years ago all ore was moved underground by hand tramming. The surface openings were numerous and fairly close to the ore being mined. Then, as the tramming distances increased from the surface openings, animals were brought into service; but here again only a few cars were moved at a time and tonnages handled per day were small. As the workings grew farther and farther away passing tracks had to be provided at certain intervals to allow trains to pass each other. In other cases trips were broken into relays—one animal brought the loaded train to a loop only part way to the yard or shaft station, picked up a train of empties and returned, while another animal pulled from this loop to another and so on. In a few cases where trains from several headings used same portion of track for a short distance some simple forms of signals were used.

ADVENT OF POWER LOCOMOTIVE BROUGHT NECESSITY FOR ADEQUATE SIGNALS

Then came the power locomotives. At first they were used on main lines only, to which cars were brought by hand or animal. Later, with the development of the compressed-air and storage battery locomotives, they were used for gathering also. The coming of the locomotive made the haulage underground much faster and cheaper and helped make possible the handling of the large tonnages required by low grade ore. Haulage lines have gradually been concentrated to fewer levels and surface openings so that now as much as 20,000 tons or more are handled daily on one level in some of the larger mines. Under these conditions many trains are required to use the same tracks. Traffic would therefore become much congested at some points and many delays take place were it not for the highly developed signal systems in use.

While haulage systems have been developed gradually until the large mines have much equipment using the same tracks, we still have many of the older methods of haulage. Hand tramming and animal haulage will continue to hold a place in many mines due to the different methods of mining, different sizes and shapes of ore bodies, and the quantities of ore to be moved. Yet most mines use signals in some form or other for routing their trains, minimizing delays, and preventing accidents.

In some cases it has been found more advantageous to use train despatchers than to install signal devices. When many trains using different branches come on to the main line near the same point, a despatcher is often placed there to facilitate their movements. Again, when several pockets are available for receiving ore, and when waste must be sent to various places, a despatcher is desirable.

The despatcher often is simply a flagman at a busy point. Others have mechanical signals to operate at more distant points, such as bell cords

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leading to whistles at branch lines, lights to be flashed, electric horns, etc. At the Inspiration Mine at Inspiration, Ariz., the despatcher station is equipped with a switch control board whereby the despatcher throws electrically all track switches in a certain block, thus giving him complete control over all trains passing through that block. Despatcher stations are in a few cases established in connection with a signal system.

SIGNALING BRINGS SAFETY, ECONOMY, INCREASED TRAFFIC CAPACITY

The chief object of all signaling is safety, but it will also be found that the prevention of accidents that cause injury also prevents accidents that cause delay and money loss, and thereby increases the traffic capacity of the haulage system.

Signal systems vary from many simple forms to the highly complicated electrically operated block signal systems. The simplest form of signal is used at shaft stations or points where a main line branches a short distance from the shaft station and on which loaded trains are brought in from two or more branches. It then becomes necessary to signal incoming trains whether or not the common track or the shaft station is occupied. Various means of giving these signals are employed from the placing of a lever in certain positions, or use of standard railway switch lamps (oil burning) to the use of colored electric lights. Electric lights have proved most serviceable. The light switch is set near the point of branching and is thrown by trainmen of an incoming train to give a red light. It is again switched to a white or other colored light as the train leaves. One or more lights may be flashed from the same switch to provide visibility from all branches, if necessary. This operation has been made automatic in some cases. With trolley locomotives it is done by placing the light switch where trolley runner will strike it as it goes in and out of the station. Other locomotives have projections on them for striking the switches.

However the problem usually met is that of long main lines with many branches coming in at various places. The presence of trains in limited portions only need be indicated at a time. A series of blocks is therefore laid out to fit the circumstances. At end of each block or wherever branches enter a block, an indication is given as to whether or not a train is in that section of the trackway. Block signals vary greatly in arrangement and apparatus employed but divide themselves into two general classes, manual and automatic.

MANUAL BLOCK SIGNALS

The manual block system is so called because the signals are operated or controlled by hand. The simplest form is obtained by running an extra circuit alongside the tracks. On the extra circuit are strung red lights at the ends of the blocks selected, at curves and at branch lines. At the ends of the block switches are placed. Whenever a train enters a block, the driver or trainman throws the electric switch to side lighting the red lamps along the block. When train leaves the block, switch at that point is thrown, cutting out the red and turning on the white lights.

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AUTOMATIC BLOCK SIGNALS

An automatic block system is a system in which each block is power operated, usually electric, and is controlled by the one or more track circuits extending through that block, so that it is automatically set at stop when a train enters the block and so remains until the block is clear.

The entrance of a train into a block at either end or at an intermediate point, as from a branch, the presence of a car in the block or inside certain limits of the turn-outs, or the setting of the track switch for a turn-out, will cause the display of a stop signal until the switch is in proper position and every part of the track included in the circuit is clear and safe for passage.

All underground automatic systems are necessarily arranged so that when necessary the signals may be passed when in the stop position. Provision is made that a train may proceed, when it is deemed advisable, by sending a flagman ahead at a certain distance. Underground trains usually travel at a speed such that they can be stopped quickly when necessary.

The operation of the signal lights is generally accomplished through track circuits whose current is of low tension on account of the imperfect insulation. At each rail joint bonds are made with wire to secure electrical continuity, and at the end of each block section there are insulating joints in the track. Control by track circuits is the only system recognized today by experts as fundamentally safe, as it gives each train the means of maintaining at all times its own protection.

THE INSPIRATION SYSTEM

At the Inspiration Mine of the Inspiration Consolidated Copper Company an automatic block signal and despatcher system is in operation on the 600 level. This system is an adaptation of the standard equipment used for high speed surface railway traffic.

The trains on the level are made up of 5-ton ore cars pulled by compressed air locomotives. These locomotives have a maximum speed of 10 to 12 miles per hour, but are limited for safe operation to 8 miles per hour on tangents and to 5 miles per hour on curves or when passing over switches that face an approaching train. The average mine haul is 0.475 miles. An average of 217 round trips per day is made to the tipples at the main shafts with ore, and about 30 trips per day are made on the level with waste and supplies, giving a total of 247 train trips per day. An average of 232 of these round trips or 464 single trips is made per day past one point; 496 trips have been known to pass this point. To properly handle this traffic the automatic signal system was installed with a despatcher station at the busy point.

The level is divided into a number of blocks. At the ends of each block and at other prominent points on the main lines are placed signal lights. On the curves of all turn-outs from the main lines are also placed lights.

The signal lights are operated by means of track circuits; lights are changed automatically by the passing of a train or the throwing of a

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track switch level. A red light is used for a danger signal. A blue light means safety. A green light is a switch light and indicates that the track is clear on the siding or turn-out to which the switch leads.

The lamps on the main line always show blue when the tracks are clear. The lamps on the curves of the turn-outs of the loading drifts, always show red until the track switch to the main line is thrown, and then only when the main line is clear will it show blue. When a train is about to pass from a loading drift to a main line, a helper must precede it and throw the track switch before the blue light will be displayed at the entrance to the loading drift.

Red lights always show when trains or cars are on the tracks, when track switches are open or split and when electrical connections are broken. Trains are permitted to pass red lights only after investigation as to the cause, and then only by sending a flagman ahead.

No light has the same significance as a red light and trainmen must stop until passage is proved to be safe and then proceed as in the case of the danger signal.

Each of the signals consists of two 110-volt, 10-watt, 2-candlepower lamps in multiple. These lamps are mounted in porcelain receptacles in a small cast-iron box. The boxes are equipped with 4½-inch diameter lenses and with guides which slip over brackets attached to caps or posts or drift sets.

THE TRACK CIRCUIT

The track circuit is the heart of the system for it furnishes the power necessary for operation of the signals. The power used for operating the lamps is 25 cycle A. C. The line current as received from the substation in the mine is 110-volt. Track transformers are placed in each block, which operate upon 110-volt primary and give almost any voltage up to 14-volts on the secondary for the track circuit.

Rails under the best conditions make very inefficient transmission lines. Hence track relays are introduced to make possible the operation of the signals when only a small amount of energy is received from the rails. The relay controls through its contact points another circuit supplying power to operate the signals.

The relays and track transformers are housed in cast iron boxes.

Rail joints at the ends of each block are insulated to prevent flow of current from one block to another. Bonds on joints in a block are made with wires outside the angle bars and connected to the rails with channel pins.

TRACK SWITCH CIRCUIT CONTROL

An important feature of the installation is the track switch circuit control which causes the proper signals to assume the danger position when a switch is open or split. Track switch circuit controllers are attached by means of adjustable rods to points of all switches. Contacts are arranged so that they will make or break when the switch points are moved from the closed position one-quarter of an inch. A switch box is placed at each switch.

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THE DESPATCHER STATION

The despatcher station is the key point of the haulage system. All trains hauling ore to or returning from the tipples at the main shafts go past this point, and most supply and waste trains also pass there sometime during each shift. For that reason a despatcher was placed there to properly route the trains to prevent accidents and delays caused by many trains gathering there at one time.

At the station is a 24-lever capacity switch interlocking machine, equipped with sixteen levers. Each lever of the interlocking machine controls a mechanism which operates a track switch. The mechanism consists of a series wound D. C. motor connected through a shafting and friction clutch to a gear arrangement for throwing the switch.

The mechanical operation of the track switch also operates the signals of the block signal system. In addition the despatcher has independent means of signaling the trains when he wishes them to proceed or stop.

Indication is given on the interlocking board when a track switch is not thrown completely and locked in position. Provision is also made so that a switch cannot be moved under a passing train which would split the train so as to run on two tracks; in case of a wreck or other emergency the switch may be thrown by unlocking the control lever. A 1 x 1½-inch pane of glass with the switch number on it, is placed above each lever and has a small electric lamp behind it; this pane is illuminated when a train is within a certain distance of the switch.

The despatcher has direct telephone connection with the tipple station and another with a switch which cannot be seen from his station.

EXAMPLE OF OPERATION OF SYSTEM

A train is to be taken from loading drift 40 to one of the tiples at the main shafts. As the train approaches the entrance to the main line the front flagman runs ahead and if the main line appears to be clear in that block he throws the switch; the red light is thus changed to blue and the train may proceed to the main line. If the red light had continued to show, it would have indicated that the block was not clear and the train would have waited until it was cleared. To continue into the block a blue light must be showing. Then to get from the block into another block a signal must be received from the despatcher in addition to the block signal at that point. The despatcher determines to which tipple it can be sent and gives it the right of way by throwing the proper switches. A train going back has somewhat the same procedure.

AN ABSOLUTE PERMISSIVE BLOCK

One block of the system is wired to give what the railways call an "absolute permissive block". By this is meant that following trains are permitted to enter an occupied block, prepared to stop on a flagging signal, while opposing trains are given an absolute indication to stop. This block is on a turnout which leads to several loading drifts. At the entrance to the block are placed three signal lamps in a row—red, blue and green. Only three indications are given by the lamps. The red

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light alone as in the regular system indicates danger. The blue light indicates that the track is clear. The red and green together indicate that the track is occupied by a receding train and that a following train may enter but must be prepared to stop at any time. This permits a number of trains to follow one another into the block and thereby increases the capacity of that section of track.

REQUISITES OF BLOCK SIGNAL SYSTEMS

In all block signal systems there are a few fundamental requirements that must be met to carry out their purposes.

In the first place a system must be simple and easily understood by the train crew. Mine haulage conditions differ much from surface railways in this respect. A locomotive driver on the railways reaches his position only after many years of service; in a mine the train crews change more frequently, and men from almost any other occupation may soon be running locomotives. Also, a train in a mine usually goes backward as much as forward, so the rear flagman must also watch the signals. He may not have worked on trains before, for in emergencies it is sometimes necessary to use men from other parts of the mine as flagmen. The signal system must therefore be one which the trainmen can comprehend quickly. Indications that trains are in neighboring blocks are usually confusing and often unnecessary; it is best to have each block complete in itself, if possible.

Next, there must be a positive signal for proceeding, not the mere absence of a signal. Then if a light goes out, a danger signal will not be accidentally changed to a clear signal.

For the same reason that blue or green instead of white lights are used for the signal to proceed. The breaking of a red lens will not therefore change a signal from stop to proceed, or a neighboring white light be mistaken for a signal light. In manual block systems it has been common practice to use only red and white lights, but the practice should be discouraged.

CHOICE OF SYSTEMS

The choice of a block signal system depends upon the volume of traffic to be handled. Mines having many haulage levels have usually only a few trains to a level and find manual operation of the blocks adequate. Layouts of many levels can be arranged with run-arounds and with one-way traffic on certain lines so that manual systems are permissible. But mines having a concentrated mining area and handling large tonnages of ore and waste find the automatic system a necessity.

There are many forms of block signals between the simple block and the automatic system. An interesting one is used with trolley locomotives by the Arizona Copper Company. A wire was strung parallel to the trolley wire, connected to lamps at each end of a block and grounded. Current was furnished the lamps by the pantagraph collector bridging the trolley and signal wires. The indication of a locomotive in the block is positive, but the presence of cars without a locomotive gives no signal. Its principal feature is the low installation cost.

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The manual method has the advantage of low cost of installation and maintenance; also its blocks can quickly and easily be changed or extended.

The automatic (track-circuit) method has the special advantage of eliminating the human factor in signaling as far as possible. The use of track circuit control of the signals makes the train at all times active in maintaining its own control. To quote J. P. Coleman, Third Annual Report, Block Signal and Train Control Board, Interstate Commerce Commission:

"Perhaps no single invention in the history of the development of railway transportation has contributed more toward safety and dispatch in that field than the track circuit. By this invention, simple in itself, the foundation was obtained for the development of practically every one of the intricate systems of railway block signaling in use today wherein the train is, under all conditions, continuously active in maintaining its own protection. In other words, the track circuit is today the only medium recognized as fundamentally safe by experts in railway signaling whereby a train or any part thereof may retain continuous and direct control of a block signal while occupying any portion of the track guarded by the signal."

Direct and alternating currents are both used for track circuits. The alternating current system gives more economical operation and maintenance. An A. C. track circuit is obligatory in mines using trolley locomotives in order to prevent the track relays from operating on the traction current or stray currents.

The development of railway signaling in general has called for much study and a large money outlay. In all haulage work of any consequence the problems of safety and economy are involved, one with another, and cannot be perfectly solved. The block signal system was introduced primarly for safety, but where trains are frequent it has become an element of economy.

DISCUSSION

Mr. C. E. Hodges, of H. K. Porter Company, Pittsburgh, stated that there are 464 trains, both loaded and empty, which enter and leave the tipple in 16 hours at Inspiration Mine. The trains are dumped at the rate of 14 per hour; they consist of 20 cars, and 5 cars are dumped at a time in two rotating tipples. These resemble city subway stations, only the trains are far more frequent. Mr. Hodges thinks that the Inspiration Mine has attained safety in haulage with a maximum degree of efficiency.

The cost of haulage at the Homestake Mine was 14 cents a ton mile, where 36 locomotives handled 4,000 tons of ore daily. At the Inspiration Mine there are 12 locomotives handling 23,000 tons of ore daily. At the Homestake Mine one-ton cars are used, with from 12 to 15 cars to a train; at the Inspiration Mine five-ton cars are used, with 20 cars to the train. The principal expense in haulage is the wages of the men. The train crew's wages are distributed over a far greater tonnage in the Inspiration Mine than in the Homestake.

A question regarding the size of cars was brought up. This depends upon conditions. At the Inspiration Mine the tracks resemble the main

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line of the Pennsylvania Railroad, and the grades have been worked out to a nicety. The five-ton cars add nothing to the accident hazard, and are far more economical.

Mr. Joseph W. Reed stated that his company has practically discontinued the use of compressed air locomotives on account of the large space occupied by the tanks, and the heavy fog given off from the exhaust. Mr. Hodges answered this by stating that the air exhaust from compressed air locomotives contains no moisture, but it produces a foggy appearance in some cases by reducing the temperature of the mine air below saturation, thus making it give up its moisture. Fog produced by steam is due to the condensing of the steam by coming into contact with cold outside air.

Prof. Raymond thinks that it would be interesting in connection with animal haulage, rope haulage, storage battery haulage, trolley haulage, etc., to determine the points in favor of each, and recommend how far it is advisable to use storage battery locomotives or trolley locomotives in coal mines. He desired to know for what distance a storage battery locomotive could be used, in comparison with a trolley locomotive, and with what degree of safety. Mr. Patton stated that no one has arrived at a determination of the limitations of the storage battery locomotive, that it depended entirely upon the battery capacity. He mentioned a mine in Kentucky where he conducted tests with a five-ton locomotive that averaged 16¼ miles per day of 8 hours. This locomotive ran as high as 117,000 feet in one day. The battery capacity is fixed just the same as the storage capacity in a compressed air locomotive. With a reel and cable locomotive you can work just as far as the length of the cable will reach beyond the limit of the trolley wire.

Mr. R. L. Kingsland stated he disagreed with the recommendation of the storage battery locomotive against the cable reel locomotive, because in small operations where only one locomotive is used for gathering, and the mine operator cannot afford to give these batteries the proper supervision which is obtained when a larger number of storage battery locomotives are used. A cable reel locomotive does not require the same skill in its maintenance.

Colonel Ritson asked if trolley locomotives or storage battery locomotives are used in dry and dusty mines, stating that sparks are likely to be given off by either. Mr. Kudlich said that in several bituminous mines in western Pennsylvania inspectors have barred trolley locomotives, but have permitted storage battery locomotives. If this feature is not covered by the mine law the inspector has authority to rule out any equipment considered dangerous.

Mr. Frank H. Kneeland (*Coal Age*, New York City), stated that the greatest point of danger on the trolley locomotive is the trolley wheel at its contact with the wire. This is where there are the greatest number of sparks. A second danger point is the commutator, where sparking is likely to take place; and a third is the brake-shoe or the contact of the wheel with the rail. Those are mechanical sparks caused by the grinding of one piece of metal against another. The storage battery locomotive

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obviously eliminates the first and greatest source of danger. The commutator can be readily boxed with gauze, but the brake-shoe hazard is common to all locomotives. Even a mine mule may cause a spark if he strikes a shoe against a stone or rail.

IGNITION OF GASES BY SPARKS

Mr. Kudlich stated that brake-shoe spark tests had been made by the Bureau of Mines at Pittsburgh, where sparks were thrown off in a gaseous atmosphere, but failed to ignite the gas. Emery wheels were used against cast-iron wheels, and an emery wheel was also used against steel, cast iron and chilled steel. The cast iron gave considerably more sparks, but in no case were the sparks hot enough to ignite the gas.

Col. Ritson then gave an experience he had in Scotland, in which a disc machine was used in undercutting the seam, and it made a continuous succession of sparks. The gas ignited and ran along underneath the cut. Thinking that this was a faulty machine, a new one was put to work in the same place. The gas was ignited again, and investigation showed that sparks would fly back a yard or more from the points of the picks, which indicated that it is possible to ignite gas by sparks from frictional contact between either metal and stone, or metal and metal.

Mr. Ryan said that all of the explosions in western Pennsylvania since 1917 have been caused by sparking of a trolley locomotive at contact of the trolley and wire. Prof. Raymond advised storage battery locomotives for gathering when the haul did not exceed 1,000 ft. in preference to cable reel trolley locomotives.

In reply to a question by Col. Ritson as to what precautions were taken in gaseous and dusty mines, Mr. Kingsland stated that in a gaseous mine operated by his company the gases are analyzed daily, and no one is allowed to work where the gas tests indicate more than a tenth of 1 per cent of methane. Tests are made up to the face. Dusty mines are ventilated with steam driven fans and a high degree of humidity is maintained by means of the fan-engine exhaust. It is far better to keep the humidity up than to resort to sprinkling, because sprinkling makes a film of dampness over the surface, but the dust is perfectly dry underneath.

To a question by Col. Ritson if sparks arise from the contact of the wheels of a storage battery locomotive with the rail, Mr. Patton replied that this condition does not exist unless there is sand on the track.

Mr. Reed stated that he did not believe conditions applying to the comparatively shallow mines in this country—running down to only 500 feet—would apply to the deeper mines in England with their greatly increased temperatures. The mines in America are considerably below the temperature of the outside air except during a period of four or five months, and require less moisture to bring them up to 100 per cent humidity than is found in outside air, whereas the mines in England during the entire year would require a greater amount of moisture to bring them up to 100 per cent humidity.

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WEDNESDAY MORNING SESSION

CHAIRMAN Tillson presided at the Third Session, at which Mine Fire Prevention and Fighting was discussed.

FIRE PREVENTION AND FIGHTING IN ANTHRACITE MINES

WILLIAM L. JACOBS, CHEMIST, SUSQUEHANNA COLLIERIES COMPANY, WILKES-BARRE, PA.

One of the fundamental principles of preventing fires is to obey that well known sign, "Keep all Lights and Fires Away," but when applied directly to mining it is practically impossible to obey that sign. If we did, many mines would be idle. It is necessary for us to take chances. It is the wise selection of these chances, the choice of the one having the least risk, that puts our mine bosses and safety engineers to the test of good judgment.

As each anthracite region has characteristic dangers, and each mine in each one of these regions has its own dangers, we cannot lay down any fixed rules of safety to prevent fire.

In a mine or section of a mine, free from gas, open lights are perfectly safe, except when carelessly brought in contact with the timbers or easily combustible materials. In all other sections, open lights should be prohibited. Notices should be posted in the gangways at the limits of the open light section, calling attention to the fact.

ELECTRIC LAMPS AND SAFETY LAMPS

Electric cap and hand lamps have become very popular in the past few years. The safety advantages of the electric lamp are great, chief of which is the impossibility of igniting timber or gas. It also gives much greater light, which enables the miner, laborer, driver, or other person, to see better, making it safer to climb dangerous pitches, or work about moving trips of cars.

Although the electric lamp can be, and is used in gaseous sections of the mines with safety from fire, it is not by any means a safety lamp, as it does not indicate gas. It should be used by the miner with a gauze safety lamp. Our experience has been that a man will unknowingly walk into a body of gas with only an electric lamp and become suffocated. All safety lamps should be securely locked, to prevent the workmen opening and relighting while in a gas laden atmosphere.

Another factor is the spontaneous combustion started in anthracite mines by throwing old mine timbers down abandoned breasts, together with oil waste, mule manure, or other organic materials. Spontaneous combustion from this cause may be entirely prevented by taking this material outside. Combustion from old timbers left in old abandoned sections, which have become inaccessible to reach, cannot be very well avoided. Generally speaking, spontaneous combustion does not occur in anthracite mines directly from the coal alone.

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Another factor in preventing mine fires is the selecting of a proper explosive to break the coal. The ideal explosive is the common black blasting powder, but in gaseous sections black blasting powder is extremely dangerous, because it easily ignites any standing gas or blowers. In these sections we used what is known as a permissible powder, composed of materials giving a much shorter and cooler flame than black powder. These safety powders are tested out by the Bureau of Mines for their safe qualities in gas before they are allowed to be put on the market by the powder companies. The doing away with squib firing and substituting safety fuses and firing by electric batteries have also been large factors in preventing mine fires.

VENTILATION A BIG FIRE PREVENTION FACTOR

Good ventilation is a very great factor in preventing fires, because good ventilation will keep all the gangways, airways, breasts, headings, etc., free from standing gas, which if left undisturbed may become ignited and set fire to the timbers, brattice, or any other combustible material.

During the past few years strict orders have been given prohibiting the carrying of matches in our mines, and smoking. This order has undoubtedly been a factor in making fewer fires.

Mines using compressed air for motive power have a fire safety measure already installed because the air pipes can be converted into water pipes to convey water to a fire section. All other main gangways should have pipe lines that could be used for this purpose; also a quantity of cotton fire hose should be kept in certain sections. We find a rubber covered hose in the mines gives best service. The rubber cover protects the cotton duck from mould and rot due to the dampness. Chemical fire extinguishers should be kept inside, or near the head of the shaft. Any liquid put on a mine fire should be applied with caution, as a steam explosion is quite likely to occur.

Electricity has become the great factor inside the mines for power and light. Although it is now indispensable, it adds to our fire risk, especially in sections that might accumulate gas by the leaving of a door open, or a stopping starting to leak, thus dangerously changing the ventilation. This point should be closely watched by fire bosses and safety inspectors. Electricity should never be installed where there will be a possibility of gas accumulating and being set off by sparks.

There is one fire risk, quite common in some veins, which is really impossible to prevent, and that is sparks caused by falls of top rock igniting the gas and ultimately setting fire to the coal and timber.

The fighting of mine fires is a subject which would take volumes. A safe general rule to follow after having determined that a fire actually exists is to organize a working force led by men familiar with the work in the distressed section. These men make it safer for all concerned. Keep all excitable and timid men away, or give them jobs on the surface.

If necessary, make a thorough examination of the section with rescue apparatus and air testing apparatus, gathering information from all persons last in the section, then with officials and inside bosses go over

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the maps and determine on some plan of action; after deciding, get on the job as quickly as possible. Take no unnecessary chances, and play safe in every respect. Observing this point may save lives and extra work in closing the section.

Of the various ways of fighting mine fires, sealing is probably the one most used. We feel that there is no fixed rule in the method of fighting fires. Each fire is a special case in itself, and must be approached and fought according to the conditions. Which of the several methods of attacking fire—to use flooding, loading it out, putting water directly on it, or sealing it—will depend on conditions, but the one thought to keep in mind is to apply the quickest and safest method to give results.

SEALING OF MINE FIRES

Our experience with the sealing of mine fires has been somewhat varied in methods of attack. Some conditions allowed us to totally seal off with stoppings, others we were only able to seal the bottom, or as might be said shut off the drafts. Another way would be doing just the opposite, shutting off the top or chimney. This latter method is now being used at one of our operations. The lower part is open, due to inaccessibility of approach on account of old workings, and also, in order to keep another level working, a booster fan is kept going. This holds the air up in the so called sealed section.

Analyses of the air from the upper stoppings shows the oxygen nearly exhausted and our CO reduced to a minimum, showing that our upper stoppings are tight and that the fire is consuming the oxygen. Just as soon as this low oxygen air reaches the fire it will put it out. Of course it is all guesswork when this actually happens as we have never seen the fire, nor do we know its exact location.

When the fire was first suspected, in order to get the approximate location and determine what airways to shut off, we tested numerous places with a CO indicator. This gave us all the clues necessary as to where the stoppings should be placed. After the stoppings were put in, the air in the upper airways began to accumulate CO_2 and depreciate in oxygen. As the breath from the fire accumulated we obtained it further down the pitch. Every two weeks we made an analyses of the air back of the stoppings, but twice a week the foreman tests the air himself with the CO indicator. This tells the increase, decrease, or disappearance of the CO at various levels.

We all know the reason for sealing is to keep fresh air from the fire. Therefore what stoppings we have must be tight, whether they are placed to shut off the draft, or shut off the chimney, or surround the fire. Concrete stoppings are excellent. Wood stoppings are good, but will dry out and leak even if cemented. In order to overcome this we coat the outside with a plastic roof material made of asbestos fibre and asphalt. This will dry and always be gummy enough to accept any slight movement of the wood and still keep the stopping tight. This material can be applied to a cement stopping, brick, stone or one made of expanded metal with cemented coating.

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It has often been stated that if we couud fill the fire area with some inert gas, such as carbon dioxide, nitrogen, etc., it would extinguish the fire. This is true, providing the section was sealed tight, but the task of filling the area with gas would be enormous and very costly. As the breath of the fire is its worst enemy, why not seal tight and allow it to put itself out? If the fire is large in size the results will be quicker. If the fire is small and confined in a large sealed area the time necessary to consume all the oxygen would be so great in this case, it would pay to give the fire air and allow itself to increase in size so when the air was shut off the time required to consume the oxygen would be less. This has been done several times to our knowledge.

If a fire should be located in an old abandoned section, where the strata is broken through to other old veins or to the surface we have one of the most difficult conditions to cope with. Under these circumstances our brightest hope is to determine the inlets; in this case we would recommend trying to put air depleted of oxygen, such as stack gases, into the main intake. Even this would be a gamble owing to possibly many inlets, but we would be sure that some of it would pass over at least part of the fire area, and what did, would smother that part.

EXPLOSIONS IN SEALED MINES

Another feature, when sealing a mine fire, which may develop and cause trouble is that when placing the last few stoppings, mine gas may accumulate above the fire causing an explosion and blowing out these stoppings. These explosions may be at regular specified intervals or differing in length of time between intervals.

We have found from experience that quickly replacing a blown out battery will lengthen the interval between explosions, but at one of our fires the batteries were so located it was necessary, after quickly repairing them, to get so far away one could not tell just when the explosion occurred. It was then necessary to cautiously crawl back to inspect; if the battery was found wrecked, we had no way of telling how long ago the explosion happened.

To overcome this uncertainty and to know the exact time of explosion so that we could immediately return and rebuild the stopping, the inside foreman built a wood frame on all sides of the opening outside the wrecked stopping, then fastened a small roll of canvas at the top of this frame. When the explosion occurred the vibration unrolled the canvas, forming a traplike canvas door, thus immediately preventing a large amount of back lash air rushing in to feed the next explosion. In order to know just when all this happened an arrangement was made so that an electric connection was made by the falling of the curtain. This rang a bell at the head of the shaft. An old mine telephone wire already strung along the gangway was used. However, it would have paid to string new wire if it had been necessary. After a few explosions the intervals became greater until we were able to build the battery permanently.

I might say in conclusion that we think the safest and least expensive way to fight a mine fire is to take all precautions to prevent it.

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FIRE PREVENTION AND FIGHTING IN THE ANTHRACITE MINES

H. H. Otto, Chief Engineer, Lehigh Coal and Navigation Company, Lansford, Pa.

In the anthracite mines of Pennsylvania there are a large number of fires every year. They are the cause of considerable extra cost to the operating companies. To the writer's knowledge there have been no accidents of any consequence—none entailing loss of life—in fighting the fires in recent years. Some mine fires are extinguished in a few hours, but many of them take from 24 hours to a week, and a small percentage several years to extinguish. A number, such as the Summit Hill Mine fire, Sioux fire at Mt. Carmel, the Carbondale fire, and a few others are very old. The Summit Hill fire is more than fifty years old; the Sioux fire has been raging twenty years. These two are crop fires, and except for the tremendous cost of fighting them, may be passed by insofar as safety features go, as practically all the work on them now is open cut work. The underground work in connection with the Summit Hill fire was very dangerous and was completed some years ago.

PREVENTION MEASURES

To prevent mine fires the various causes must be carefully studied and prompt steps taken to eliminate them. Mr. Douglas Bunting in his paper "Mine Fires Extinguished by Sealing" before the American Institute of Mining and Metallurgical Engineers at their recent meeting in Wilkes-Barre, gave the followng causes: Smoking, electrical installation, gas explosion, gas feeders, communication of fire to the outcrop from ash dumps, culm bank, timber and brush fires, and the main cause as open lights. By Act of Assembly June 15, 1911, after the Price-Pancoast disaster at Throop, inside buildings such as engine rooms, pump rooms, barns, etc., have to be constructed of incombustible material. By proper ventilation the cause of fire from gas explosions and gas feeders has been reduced considerably. Many companies absolutely prohibit smoking inside, even in non-gaseous mines. The use of electric mine lamps has been a big step in reducing the fire hazard, which is present in heavily timbered mines when naked lights are used.

By the removal of old timber, iron rails in gangways and breasts, sheet iron in chutes when places are finished, the fire risk is reduced considerably. In damp places, if rails and sheet iron are left in, a short circuit may occur causing an arc, which has been known to set timber on fire in a few hours. Most mine fires, if discovered within a few hours after starting, are extinguished in less than 24 hours. The Lehigh Coal and Navigation Company have fire patrolmen who travel the workings after the men are out in an endeavor to locate fires before they can obtain a start. Constant vigilance and frequent inspections are very big factors in the prevention of fires.

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EXTINGUISHING MEASURES

Despite all the efforts of the men and the management, fires occur much more frequently than is generally supposed and from causes apparently beyond control. To aid in fighting the fires promptly, the coal companies have spent considerable money in equipment used for fire purposes only. Fire extinguishers are kept in accessible locations. Where there is sufficient water running in the gangways portable electrically driven fire pumps are kept inside near the foot of the shaft or at the top of the shaft. A supply of standard fire hose, wrenches, nozzles, etc., is kept at various points. To supplement this equipment, the Lehigh Valley Coal Company has a fire equipment car. This is an ordinary freight car fitted up especially to hold a large supply of 2½-inch gas pipe, hose, axes, hammers, brattice cloth, extinguishers and other necessary fire fighting equipment. The car is kept in a central location and can be readily sent to a colliery where a mine fire exists. All material which deteriorates is replaced at regular periods with new material. With this car is a converted passenger car in which are kept mine rescue equipment and first-aid supplies. Companies like the Lehigh Coal and Navigation Company, whose mines are not scattered, keep a good supply of fire and first-aid equipment at a central point and transport it with motor trucks. The Lehigh Coal and Navigation Company and the Philadelphia and Reading Coal and Iron Company, and others who used compressed air, have long 2½-inch to 4-inch lines running through large sections of the mines. These lines are converted into water lines with a little extra work. In some of the dry, dusty, gaseous mines in the northern field water lines are well distributed throughout the mines.

In the flat or in the pitching veins, if the fire is discovered early it can be extinguished as a rule by attacking it directly with water. If the fire occurs in territory which has been first mined but not robbed it can be extinguished by sealing off the fire and allowing it to smother itself. This can be done in either flat or pitch workings. In robbed, caved or squeezed territory it is not advisable to depend on sealing off the fire, even though little air is traveling in the fire district. Flooding a mine by water is a course which should only be pursued after all others have been exhausted. In large mines, the damage done by the water and the cost of dewatering may make it a very bad financial proposition.

Fire travels with difficulty through fine silt. As a matter of fact, it may be extinguished by silting on top of the fire.

VENTILATION MAP AN AID

A very valuable aid to determine the proper course to pursue with regard to ventilation and withdrawing men from the mine where the fire exists, is a ventilation map or tracing. On it are shown only the rib lines of the workings. All stoppings are marked distinctly to show how they are constructed; the course of the ventilation as well as pipe lines, pumps, wires, etc., are shown. If a map of this type is posted after each general survey it will assist in fighting the fire by showing where the

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ventilation can be changed with the least work and also from what sections it is advisable to withdraw the men.

The success in fighting a fire in the mines depends largely on the ability of the officials to organize their forces promptly, avoiding the use of too large a force early, and later on having only tired men.

Mr. Bunting gave in detail the method used in sealing off two fires in flat territory. Each fire is a problem in itself and will not yield to general methods. Mr. J. B. Warriner described sealing off a fire at Lansford and at Coaldale, both of which were successful. Fighting fires in heavy pitches has all the dangers and thrills of those in the flat territory, plus the difficulties always encountered in pitch mining. We find it necessary to drive rock holes or coal holes up underneath the fire area and if possible get above the fire before water is played on it. A good and a safe plan is to get the pipe as close as possible to the fire, be sure it is properly secured and installed, after which withdraw the men and then turn on the water. Failure to withdraw the men may cause loss of life. The water may be broken up into hydrogen and oxygen, the former gas may again burn with an intense heat causing very severe burns.

DESCRIPTION OF FIRES

The following is a description of a fire at the Wm. A. Colliery of the Lehigh Valley Coal Company in January, 1918. This colliery is located about twelve miles above Wilkes-Barre. The veins are comparatively flat. A 15° plane connects the bottom and the top Splits of the Red Ash Vein. Early one morning in January, 1918, a fire was discovered in the timber along the plane. Men had been working on retimbering that night. The plane is about two-thirds of a mile from the foot of the shaft. A 2½inch hose line was run from the foot of the shaft to the fire in a very short time. Nearby borough fire companies furnished a lot of the hose. As soon as possible pipe kept at some of the nearby collieries was rushed inside and before noon two streams were playing on the fire. A cave occurred along the plane making it difficult to get at the fire. The leader of each squad was a man who knew that section of the mine thoroughly, the rest were men from the other parts of the mine. In the afternoon anothor fall occurred cutting off the leader's retreat down the plane. He fought his way through the heat and smoke to the top of the plane and then through 150 feet of smoky traveling way to good air, not much the worse for his thrilling experience. Early in the morning, the whole force, including officials, was divided into squads and worked accordingly. A relief station was established and the men were dispatched from it at regular intervals. When the men returned they reported to the man in charge and were supplied with blankets to guard against colds. The first-aid station and mine rescue apparatus were also located at the temporary relief station. It was not necessary to use the mine rescue apparatus. As the fire was discovered before much progress had been made it was extinguished within 24 hours. As the men were gathered together hastily, the management supplied them with hot coffee and sandwiches, which aided in keeping up the general morale.

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At Nesquehoning Colliery early one morning last fall a fire was discovered at a booster fan at the face of a gangway in the Primrose Vein. When the night patrolman made his last trip everything was in good condition, no fire had started. Sometime after this a slight fall occurred knocking down the wire connected with the fan, thus causing a short circuit and igniting the timbers, throwing off dense volumes of smoke. A number of the men tied handkerchiefs around their mouths and noses and managed to get the fire pump in close to the fire. Fortunately there was an open air hole near the face of the gangway which carried away most of the smoke while this was being done, after which it was closed to prevent the fire from traveling up the pitch. This put the smoke all the way out the gangway, necessitating the use of Gibb's apparatus, which had been sent for early in the morning. With the aid of the oxygen breathing apparatus we were able to play the water directly on the fire. Above the trap door was a supply of fresh air into which the fire fighters retreated when necessary. As a result of the prompt work of the colliery officials and men, the fire was extinguished in less than 12 hours, with very little damage other than destruction of the fan and two or three sets of timber.

If the fires in the heavy pitching thick veins are not discovered soon after starting they are likely to be long drawn out and expensive battles, involving expenditures of from $25,000 to more than $200,000 on inside fires. The principal expense is in driving rock holes, rock and coal chutes, tunnels, etc., to fight the fire and get ready locations to turn water into the fire area. One fire at Coaldale necessitated the driving of 1,500 feet of rock chutes and 2,000 feet of chutes and headings. In addition to these a tunnel was driven into the fire area. This fire was finally extinguished by sealing off the area. At another fire at Lansford No. 4 Slope, in addition to the rock holes, chutes, etc., five 10-inch churn drill holes were drilled, only two of them succeeding in reaching the vein. The others were abandoned in caved territory. Depth of the holes reaching the vein was about 700 feet. They released considerable gas and were used to run silt and water into the fire area, which had been sealed.

MINE FIRE PREVENTION AND FIGHTING IN BITUMINOUS COAL MINES

JOSEPH W. REED, DIRECTOR, DEPARTMENT OF SAFETY, THE CONSOLIDATION COAL COMPANY, INC., FAIRMONT, W. VA.

From our point of view, safety, we must, in addition to the prevention of ignition of fires, consider the prevention insofar as possible of the quick propagation of the fire, not only of the flame and heat, but also of the smoke and poisonous gases throughout the mine. We must consider this subject from the point of view of the open light mine as well as that of the closed light or so called gaseous mine. The subject is divided into two parts. The prevention of fires caused by contact between flame and

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combustible material, and of fires caused by the arcing or overheating of electrical circuits or equipment.

As far as fires caused by contact of flame with combustible material are concerned, fire prevention inside the mine is identical with fire prevention in buildings—it is things of seeming insignficance that need our most careful guarding against.

While to the fire preventionist it seems as if only the use of ordinary good common sense should be necessary to foresee and prevent these little things which are dangerous fire hazards, yet it is unfortunately true that they frequently seem invisible to many of our foremen and others employed inside of the mine. If fires are to be prevented, then most careful attention must be given to simple preventative means such as the following:

SOME MEANS OF PREVENTING FIRES

Prevention of the building of wood structures, the so called "wood shanties" inside of the mine.

Prevention of hanging of coats, feed sacks, etc., on wood or flammable brattices.

Not permitting trapper's benches to be built against door frames.

Careful inspection of the face for fires, before leaving the mine, following the use of black powder for blasting.

For the prevention of fires due to overheating of electrical circuits or equipment it is very essential to have the following things followed out as closely as possible:

Housing of all high tension electrical equipment, such as inside substations and pumping stations within fire proof rooms which are equipped with heavy iron doors at all openings leading from same.

Adequate protection from overload by circuit breakers located at the power stations.

Further protection against overload in large circuits by dividing them into smaller units by means of automatic circuit breakers installed on the more important branch circuits inside of the mine.

An adequate amount of copper in all electric feed lines for the load normally carried together with good and sufficient bonding of the rails forming the return side of the circuit.

Cut-out switches on branch circuits and having same opened at night or as soon as work on that entry is finished for the day or shift.

Fused "by pass" circuits bridging over the cut-out switch on such branch circuits as require power during the night for pumping purposes. Fuse being only of sufficient capacity to carry pumping load.

Use of standard trolley wiring in which the wire is required to be kept one foot outside of the rail.

Use of moisture proof tube insulators where wires pass through door frames or brattices.

Use of non-flammable material for air check curtains and wing brattices.

Automatic starters for irregularly attended stationary motors, such

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as pump motors, permitting the use of fuse of sufficiently small capacity for adequate protection against overheating and burning of armature.

Use of fire walls of brick or hollow tile between the motor and combustible material such as coal rib or timbers and sheet iron protection over top of the motor where coal or timber is close over top of the motor.

The above covers briefly the more important elements necessary to successful fire prevention, but we must not forget that the most essential feature is the use of good common sense and judgment. To be effective at all, guarding and preventative measures must be made effective throughout. As prectically all mechanical means of guarding electrical circuits do at times fall down, they must be backed up by further pro-

FIGURE 1.

tective measures, and these in turn protected against failure. Even fire walls do not afford protection unless they are properly installed and flammable material other than that protected kept outside of the fire walled area in order to prevent propagation of the flame outside of the fire walls. To show how frequently a foreman will most carefully follow out a set of fire prevention instructions, and make a wasteful expenditure of money by either later tearing part of it down, or by failing to use good common sense in making the installation completely effective, I have prepared some photographs showing faulty installations.

Figure 1 shows an automatic starter which is located in the sheet iron

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box to the left of the motor, and while it remains in good condition the installation is probably safe, but the well constructed fire wall, together with the sheet iron protection for the roof, is probably a waste of money as it has failed to provide complete protection. A tar impregnated wood pipeline of intensely flammable nature has been passed back directly over top of the fire hazard, the motor, and would quickly carry the flame out of the protected area into the mine.

Figure 2 shows a well enclosed fire area both around and over top of the motor. However, it fails to give fire protection from the fact that the starting box, only slightly less of a fire hazard than the motor, has been mounted on a wood prop without any protection in the way of

FIGURE 2.

asbestos back of it. The pumper has further rendered the walled-in area ineffective by providing a means for propagating the flame away from the burning motor by means of the oil soaked bench he has rigged up against the bed plate.

Figure 3 shows the method of mounting of our chemical fire engines on a truck so that they are easily transportable inside the mine. It also shows one of the regular trials being made of the engine for proving that it is in working condition, and to familiarize the men with its operation.

Figure 4 shows the method of construction of the railroad cars used for storing and transporting of chemical fire engines for general service at any mine.

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FIGHTING MINE FIRES

As only an approximation of perfection can be obtained in any methods of preventing mine fires it becomes necessary to provide means for extinguishing them.

FIGURE 3.

In our larger mines, especially those which are gaseous, and in which the stopping of the air current would be accompanied by serious danger, we find it advisable to provide water barrels and buckets about twenty

FIGURE 4.

feet from each side of trap doors on haulways and other doors where electric wires pass near or through same.

Small hand fire extinguishers are used to some extent, and are placed

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at points where it is felt there is more than ordinary danger of ignition of small fires.

Our larger mines, especially those classed as gaseous, are equipped with chemical fire engines of fifty or one hundred gallons capacity. These fire engines are located at central points inside the mine and are mounted on light trucks so that they can run on the mine track and thus be easily transported to any part of the mine.

For general protection of all mines and to assist the equipment at the larger mines, special railroad cars have been rebuilt so as to house and transport large size chemical fire engines. These cars are located on easily accessible railroad spurs at central points in our various fields. The fire engines on these cars are also mounted on a light truck so that when the car arrives at the mine, the fire engine can be unloaded on the mine supply track and quickly transported to the fire.

We follow the general policy that it is much easier and less expensive to have equipment quickly available for at once putting out the fire before it gets beyond control, and put forth every effort towards that end, yet we do follow the usual policy of at once sealing off such fires as show signs of getting beyond control and confining them to a certain area until they smother themselves out, or until further supplies can be brought up for a fully organized attack.

To provide against such emergencies we keep on hand at some central point a stock of metal pipe, extra fire hose, auxiliary fans, high pressure pumps, extra rolls of brattice cloth, and maintain three mine rescue stations at which are kept oxygen breathing apparatus and supplies.

EXPERIENCES IN A COAL MINE FIRE

G. M. Gillette, Manager, Consolidation Coal Company, Maryland Division, Frostburg, Md.

It is my purpose to show how a mine fire was successfully attacked by means of hose, in a manner and under conditions which would lead to the belief that it could hardly be done without loss of life or serious injury, but which was accomplished without even a slight injury.

The fire which we will consider occurred on March 6, 1916, at about 3 p. m. in Mine No. 215 of The Consolidation Coal Company, in Letcher County, Kentucky, and working the Elk Horn seam, which is a gas and coking coal of high quality and of about the following analysis: moisture 3.40, V.M. 36.75, F.C. 55.85, Ash 4.00, Sul. 0.75. The coal is overlaid by a rather soft shale which makes it necessary to leave a foot or eighteen inches of coal for roof. The coal is gained by a short slope, with manway opening on left and fan shaft on right.

The mine had just been opened up shortly before the fire, after a shutdown due to the depression of 1914, and because of this only 32 men were on the inside at the time of the fire.

On the afternoon of March 6, smoke was noticed in the air by two men who worked at the bottom of the slope. These men becoming fright-

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ened came out of the mine without giving any alarm. Soon after they came out the assistant general superintendent observed smoke issuing from the mouth of the slope. He found that both the superintendent and mine foreman were on the inside. Without waiting to make further inquiry he entered the mine for the purpose of ascertaining the safety of the men. In this he followed the rule laid down for every properly trained mining man, that in case of accident the first consideration is the safe withdrawal of the men from the mine. He quickly located the superintendent and foreman, and the men were all brought out in safety, the last to come out having to make their way through the air shaft on account of the heat and smóke.

ELECTRICITY PROBABLE ORIGIN OF FIRE

The fire originated in a wood brattice and is supposed to have been caused by the contact of a 250 volt feeder line, which passed through the brattice without proper insulation. Although the fire was gaining headway quickly, and there was great smoke and severe heat, an attempt was made to attack the fire at the point of origin with water from a pump line which ran nearby. Some progress was being made when a short circuit occurred, due to falling roof caused by the fire, and the attempt had to be abandoned. In the meantime the division manager had been notified, and the general officials of the division were quickly on the ground. An inspection was made, and it was determined that on account of lack of equipment the only course which could be followed was the sealing of the mine. By this time flames in large volume were issuing from the mouth of the slope and the tipple was in great danger of being destroyed.

The fan shaft was sealed by two layers of boards with canvas between and about three feet of clay well tamped on top. Some difficulty was experienced in sealing the manway on account of smoke, but a board and canvas brattice was built, and backed up with clay for about 8 feet.

SEALING THE MOUTH

On account of flame and smoke it was impossible to approach the mouth of the slope, and to seal it presented a problem. The mountain rises very rapidly immediately back of the slope mouth, and it was decided to shoot in the slope timbers just back of the slope mouth, and through the opening close the slope with dirt from the side of the mountain. This was successfully accomplished.

All this work was done during the night of March 6 in a rain storm and, as far as the slope was concerned, under dangerous conditions, but by the utmost care on the part of the officials and those engaged in the work no accident occurred.

On the evening of March 8 men trained in the use of breathing apparatus had arrived from the West Virginia division, and it was decided to open the mine for exploration and to fight the fire if possible. A pump was set up at the creek and a door placed in the manway outside the brattice with which it had been sealed. The fan house was rebuilt, it

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having been taken down in order to seal the shaft, and the brattice in the manway was removed. This work was completed on the afternoon of March 10 and the exploring party entered the mine. The fan, which at the time the fire occurred had been working blowing, was now run exhaust in order to carry the fresh air in with the men who entered by the manway. After several hours the fire, which was found at the bottom of the slope, gained such headway that the men were forced to leave the mine, and no further entry was made till March 12 when sufficient pumping capacity had been provided to take care of three lines of hose at about 90 lbs. pressure. The mine was again reopened at the manway, the fan started, and three fire fighting parties entered the mine. These parties consisted of three crews of hose men, brattice men, and hose couplers. All places which were open along the manway into the body of the mine were bratticed off, the entire current of air being carried with the men.

After the first attack the fire was soon driven back into the motor run around, after which a canvas brattice was put up at a point in a loaded track nearby. Two additional lines of hose had been laid and concentrated where the fire was burning with extreme fierceness. In the meantime brattices had been built at other points.

CONFINING FIRE TO SMALL AREA

The fire was driven back sufficiently to build a brattice. The fire was thus confined to a comparatively small area. At this time trouble was experienced with the steam pressure at the pumps, and it was necessary to bring up and set in place an additional portable boiler. During this time it was necessary to withdraw the fire fighters, and they were considerably handicapped.

The pumps having been started, a helmet party was sent against the fire, and after it was somewhat cooled down, a canvas curtain was built in order to direct the fresh air over the men working in the empty track so they were able to work without helmets.

The fire had now been beaten back, and the men had advanced (a brattice having been taken down) to point of pillar between empty track and motor run around, when an accident happened to the fan motor and the fan was shut down. This caused the air to reverse and the fire came back on the men, driving them from the mine. The manway door was closed and the air circulation thus cut off.

FINAL CONTROL OF FIRE

After about two hours the fan was repaired and the men were sent back. There appeared to have been ground lost during the time the fan was shut down, and it was decided to remove some brattices and attack the fire from another side. This was done at once, and after several hours of the hottest kind of work, the fire was under control and confined to a small area.

By noon of March 13 the fire had been cooled down to such an extent

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that it was only a matter of keeping water on the hot spots to completely cool them.

This whole story sounds more or less simple, but when it is considered that this region at the time the fire occurred was new, that untrained men had to be gotten together quickly for the work and sent into a mine in the condition this one was in, it is remarkable that everything turned out as well as it did.

The steel timbers which supported the slope and the bottom were completely wrecked, and extremely heavy falls of roof occurred. The mine

CUTTING AWAY THE WRECKAGE OF STEEL TIMBERS AFTER THE FIRE.

was filled with smoke and steam all the time, the heat was intense, and the roof conditions were most alarming. In spite of all this, by "making haste slowly", by carefully picking the men, and by keeping an official of experience with each party at all times, the work was successfully and safely accomplished.

FIRE PREVENTION AND FIGHTING IN METAL MINES

H. M. WOLFLIN, SUPERINTENDENT OF SAFETY, INDUSTRIAL ACCIDENT COMMISSION OF CALIFORNIA

(*Prepared with the assistance of G. Chester Brown, Chief Mining Engineer, Industrial Accident Commission of California.*)

A fire in a metal mine constitutes the most serious hazard found in the industry. As a rule, underground fires occur at unexpected times,

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when men are scattered throughout the workings, making it difficult to give them adequate warning. More than 200 lives have been lost through metal mine fires in the Butte, Mont., district alone, as shown in U. S. Bureau of Mines Technical Paper 252. The record the bureau has prepared shows 48 metal mine fires that have occurred since 1866, resulting in 446 fatalities. Also the writer in the course of his reading and his experience has listed some eleven additional metal mine fires, that have resulted in three additional fatalities. Technical Paper 286 lists four fatalities, chargeable to metal mine fires, that are not included in either of the other lists. This makes a total of 453 deaths for which metal mine fires have been responsible since 1866. However, I am sure that these lists must be incomplete, and that many more men have lost their lives, but unfortunately records of these deaths are not readily available. The record of California shows 17 deaths from 1907 to date.

CAUSES OF METAL MINE FIRES

Some of the more common causes of metal mine fires are:

1. Accumulation of waste timber, rubbish, such as refuse from powder magazines, the improper storage or temporary placement of feed for animals, machine oil, calcium carbide, electric cable with highly flammable insulating compound, cotton waste, and a large number of similar flammable supplies or substances. Fires may start due to employees' carelessness in handling candles, lamps, matches, blow torches, glowing tobacco, or failure to observe the smoldering of fuse left from blasting, the burning instead of detonation of dynamite, short circuiting or arcing and overheating of electric wires, friction caused by movement of ground especially in worked out territory or in timbered stopes, and from a variety of other causes such as the overheating of machinery bearings due to poor lubrication, which, although somewhat rare, has probably been the cause of mine fires.

2. Spontaneous combustion of ore, oily cotton waste, spoiled mule feed, manure, etc., doubtless have caused serious fires. One of the worst of the Butte mine fires is presumed to have been started by the spontaneous combustion of manure from underground stables, sawdust and paper and powder boxes, and similar refuse that was dumped into a worked out stope that was being filled.

3. Surface fires transmitted to underground workings are not infrequent. One case in California where the fire originated in a wooden head frame, caused the death of eleven men. It is reported that the burning embers fell down the incline shaft, setting fire to the shaft timbers which caused a large volume of smoke and gas to accumulate in the mine workings. The mine was dependent on natural ventilation and the air current reversed, the shaft becoming a down-cast instead of the usual upcast, probably due to the water turned on the fire, and as a result, eleven of the employees went to a shaft station probably thinking they were going away from the fire zone and lost their lives, due to the gases generated by the fire.

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INCENDIARISM OCCASIONALLY CAUSE OF MINE FIRES

4. Incendiary fires occasionally have caused considerable trouble. It is surmised that two metal mine fires in California were due to incendiary origin. In the case of one deep gold mine, pieces of candles with cotton waste and similar material piled up around them were found near one or two of the shaft stations, after the fire had been extinguished. Previous to this, another fire had been started in a quicksilver mine.

5. Old fires may revive where bulkheads are not properly watched.

6. Lack of fire inspection in the stopes is more serious than is sometimes realized. Heavily timbered mines should employ responsible men to make frequent inspections in the stopes, especially during the time that the employees are off shift. Undoubtedly many mine fires would have been prevented if such precautions had been taken.

7. Neglect to fireproof the shaft collar, shaft timbers and stations has often resulted in the transmission of a surface fire to underground workings. An active campaign is now being carried on in California toward interesting mine operators in fireproofing all buildings near the shaft collar, concreting the shaft timbers and stations wherever possible to do so. The fire hazard due to wooden headframes and ore bins, flammable buildings near shaft collars, shaft and shaft station timbers is very great in California mines. The California Industrial Accident Commission, working in co-operation with representatives of the U. S. Bureau of Mines, is doing all in its power to encourage the fireproofing of such structures.

8. In recent years there have been several instances of the ignition of flammable gas in gold and quicksilver mines, so this possibility must not be overlooked when listing some of the more common causes of metal mine fires.

FIRE FIGHTING METHODS

In general the modern metal mine fire can be fought to best advantage by the use of water, by direct application by means of hose or other devices through which the water is sprayed or sprinkled upon the fire, or by flooding the workings and completely submerging the burning materials, or by flushing sand or slimes into the burning workings. Occasionally, however, conditions are met under which it is impracticable to reach the seat of a metal mine fire by direct attack with hose, and it is equally impracticable on account of natural conditions to flood the burning area, or to flush in sand or slimes. Under these conditions it has been customary to exclude the air by means of bulkheads or brattices and permit the fire to extinguish itself, after burning out all the oxygen in the fire area. This latter method is slow for the reason that after the fire has ceased to burn, the heat is radiated so slowly that the mass of material near the sets of the fire remain above the kindling temperature of the timber for a surprising length of time. Furthermore, great difficulty is encountered as a rule, in making and keeping the bulkheads and seals tight enough to exclude all air. Then too, if the bulkhead area is large as compared to the area that is actually burning, there is so much

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oxygen to be exhausted that the process is extremely slow. Again, it happens occasionally that the use of water in the workings will do serious damage because the formation "slacks" or "swells" when it becomes wet. This formation is sometimes referred to locally as "swelling ground." It has been responsible for the expenditure of thousands of dollars for retimbering in one of the districts of California.

Recently a serious fire occurred in one of the California mines that for years had to contend with this "swelling ground." Due to a scarcity of mine rescue equipment and men to use it when the fire started, it was impossible to place bulkheads very near to the fire area. The mine is worked through two inclined shafts, and eventually it became necessary to seal these shafts at the collars. All others surface openings were sealed, after which the only way that the fire could receive air was through leakage through old square-set stopes that had been filled along the boundary line of an adjacent mine.

USE OF LIQUID CARBON DIOXIDE

The location of the fire was such that there was reason to fear the loss of valuable underground hoisting equipment and possibly the loss of the main shaft, before the mine atmosphere had its oxygen sufficiently reduced to check or extinguish the fire. Furthermore, even if the fire should be checked before reaching the electrical equipment, there was grave danger of damaging it due to exposure to moisture. There was even a possibility that the station where most of the equipment was located might be flooded before the fire could be extinguished or controlled by sealing. With these conditions in mind, together with the results obtained by the use of sulphur dioxide in fighting a mine fire in southern Illinois a number of years ago, it was decided to attempt to reduce the period that the mine must remain sealed and to give greater protection to the shaft and to electrical equipment by introducing liquid carbon dioxide.

Approximately fifty tons of carbon dioxide were introduced into the mine over a period of three days. The liquid gas was transported from the manufacturer to the mine in some 2,000 sealed cylinders each of which contained fifty pounds of liquid CO_2. This was equivalent to about 375 cubic feet of carbon dioxide at 70° F. in each cylinder.

The carbon dioxide was introduced as follows:

A two inch pipe was run from the surface through the bulkhead in the main shaft. This was connected to another section of two inch pipe that had a series of twenty connections, to each of which a carbon dioxide cylinder could be attached, so that a battery of twenty cylinders could be discharged at one time. The cylinders in the battery to be discharged were placed in old 100 pound carbide drums filled with water. A steam line was arranged so that a quarter inch pipe containing steam at a variable pressure of ten to forty pounds per square inch, gage, could be turned into the water in each carbide drum to heat the cylinders as they were being discharged. The water in the drums around the cylinders was kept at boiling point while the latter were being discharged, but in spite

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of this, so much ice formed on the tanks that they sometimes had a thick coating of it when they were lifted out of the boiling water. The carbon dioxide was started into the mine at the rate of approximately forty cylinders (15,000 cubic feet) per hour. The time required to empty a battery of cylinders was from seventeen to twenty-five minutes, averaging twenty minutes, varying with the quantity of steam available. The maximum pressure in the two inch pipe carrying the carbon dioxide when twenty cylinders were being discharged, was fifty-five pounds per square inch, gage. The cost of liquid carbon dioxide was approximately $10,000.

Due to the desire to enter the fire area at the earliest possible moment to protect the electrical equipment and to take steps to protect the main shaft, the mine was left sealed only one week after the carbon dioxide was introduced. During this time mine rescue equipment, trained men, and supplies were collected, and other preparations made vigorously to continue the fight. At the end of the week the mine was opened and after some delay and a little difficulty the mine ventilation was re-established outside of the fire area and the fire bulkhead near the seat of the trouble.

Later the fire ate its way through some old filled, square-set stopes into the adjoining mine. The operators of this property insisted that the mine be flooded because they feared a recurrence of the trouble. Inasmuch as the mines were stoped along the boundary line the flooding of one meant the flooding of both, although the fire was completely bulkheaded and under control in the mine where it had originated. Flooding absolutely was not justified by the conditions that existed, for without serious difficulty, the fire could have been controlled by other means, but no compromise could be reached so eventually the mines were flooded and could not be operated for more than eighteen months. According to reports considerable work must still be done to reclaim parts of the mine workings, and several stopes containing excellent ore cannot be recovered.

From observations made underground after the use of the carbon dioxide in the case just described, it is evident that the gas had been surprisingly effective in the area that it was possible to reach in the course of the exploration. In one instance a dry pine cap of a drift set, that was full of resin, had started to burn on one end and apparently had been extinguished immediately when the carbon dioxide reached it. From experiences with other metal mine fires it would appear that the carbon dioxide greatly reduced the time that it was necessary to keep the fire area sealed before conducting the active attack at close quarters.

As a result of this one experience with the use of CO_2 it may be dangerous to draw definite conclusions, but it appears that under special conditions carbon dioxide may be a valuable ally in fighting metal mine fires. When a direct attack cannot be conducted to advantage, or when a seal cannot be made tight enough or near enough to smother the fire, the use of an inert gas should be given thoughtful consideration. If conditions are right the gas may be made an important factor in checking or controlling the fire, while preparations are being made to extin-

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guish it completely, or the gas may make possible the reduction of the bulkheaded area to such an extent that the problem of direct attack is rendered less difficult of solution.

UNDERGROUND FIRE FIGHTING—CONCLUSIONS

1. Temperature readings and analyses of mine air samples, systematically taken, are invaluable aids to effective metal mine fire fighting and recovery operations. The analysis of the return air samples frequently gives a surprisingly accurate indication of conditions existing underground.

2. Employees must be thoroughly trained in the use of mine rescue apparatus, because a relatively slight difference in the amount of training makes a vast difference in the amount of work they can perform under oxygen. In general, slender, wiry men make better apparatus men than those of heavy, more muscular physique, although there are frequent exceptions to any such general statement.

3. Surprisingly high temperatures, up to 165° F. or 170° F. can be endured for short periods by wearers of mine rescue apparatus if the air is dry, but lower temperatures, 135° to 140° F. are almost unbearable if the air is very moist.

4. There is likely to be an urgent need of mine rescue equipment and thoroughly trained men familiar with the mine workings at every timbered metal mine.

5. The choice of fresh air bases, when performing mine rescue work, is very important, for it must be certain that the air is not contaminated by gases from the fire. If natural ventilation is depended upon the air current must be watched with care to see that it does not reverse.

6. The strictest discipline is necessary to prevent men who are returning from the fire zone from removing their apparatus before they reach the fresh air base.

7. Mechanical ventilation greatly simplifies metal mine fire fighting operations and increases the safety of the men engaged in the work.

8. The products of combustion from a fire diffuse with great facility through closely filled ground for distances that are surprising. This is true even when differences in atmospheric pressures are relatively slight, between the burning workings and those that are not affected by flames. Therefore, bulkheads in filled ground are absolutely useless for fire fighting purposes, as a general rule.

9. It is advisable to have bulkheads continuously and frequently patrolled even though they have been recently completed and carefully inspected.

10. If moist clay can be secured in sacks (or dry clay sacked and moistened) one of the quickest methods of building a satisfactory bulkhead in a drift or cross cut is to put up a wall or brattice of 2x12 inch or 2x6 inch boards nailed to posts or stulls and fitted as closely as possible at the ends, then to nail two or more 3x3, or 4x4 inch strips on the outside and add another board wall, fastened to the strips, moist clay being tamped between the walls as the outside wall is put up. The outside wall

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then should be calked carefully with clay, especially around the edges and at the top and bottom.

11. When bulkheading timber drifts or cross cuts, a tight seal rarely, if ever, can be made unless all lagging is cut and a section removed, and all loose rock and dirt taken down before the bulkhead is started.

GUARDING AGAINST CARBON MONOXIDE POISONING

12. Close observation of both candle and canary birds is necessary if men working without mine rescue apparatus in the fire zone are to be spared the nausea and excruciating headache of slight CO poisoning. If men working hard are using a bird to warn them of carbon monoxide the bird should be kept moving enough to make it pant, otherwise men may be affected before the bird shows distress.

13. The resistance of individuals to low percentages of CO varies between relatively wide limits. Frequently more robust individuals with large lung capacities are the first to succumb.

14. Timber fires burn and spread more rapidly than coal fires and conversely die down and cool off more rapidly when the air supply is checked. They are extremely deceptive and likely to blaze up when it is thought that they have been extinguished.

15. When the fresh air supply is restricted, an underground fire tends to travel against the air current, even though the current may be coming from below. On the other hand if the air is moving at higher velocities so that the supply is more plentiful, the fire may travel both ways. If the draft is extremely strong, the fire will probably travel with it.

16. Reliable means of signalling from skip or cage should be maintained at all times during fire fighting operations in shaft mines. The method of signalling becomes extremely important when it is necessary to ride skip or cage in irrespirable atmospheres.

17. The presence of carbon monoxide in the mine air indicates an active fire (except for the relatively small amounts of CO generated in blasting operations), but the absence of carbon monoxide is not a positive indication that the fire has been extinguished.

18. Finally it is pointed out that effective organization of fire fighting forces is of paramount importance. Men, equipment and supplies mean nothing—can accomplish nothing—without thorough organization and the strictest discipline. This is regarded as being the most important of all the suggestions and observations given under the heading of Underground Fire Fighting.

PREVENTION AND PROTECTION

In connection with the broad problem of metal mine fire prevention and protection the following somewhat general observations and suggestions may be of passing interest:

1. All wooden headframes, wooden structures and supplies of flammable materials near any mine entrance should be removed or replaced by fire-proof structures. If this cannot be done, then at least such wooden structures should be made as nearly fireproof as possible by means of

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gunite or some other equally efficient method. All planked floors around the collar of the shaft or at the portal should be removed and non-flammable construction substituted.

2. Mine timbers should not be piled in the immediate vicinity of the collar of the shaft or at the portal of an adit or a tunnel.

3. Proper storage of dynamite in fireproof places is essential. Boxes of dynamite should not be left near the collar of the shaft or at the portal of an adit or tunnel.

4. Removal of all accumulation of flammable waste-material and refuse from the mine or near the vicinity of the collar of the shaft is important.

5. Proper storage of gasoline or oil at an adequate distance from the mine entrance should receive attention.

6. If underground pump stations or hoist stations need support, steel and concrete or at least gunited timber should be used.

7. All oily waste should be removed promptly from the vicinity of pump or hoist stations and pending removal should be kept in metal receptacles carefully placed and protected.

8. Electrical apparatus, especially wiring and transformers should be properly installed and carefully protected. All electrical equipment should be placed in fireproof stations.

9. The installing of adequate underground and surface fire fighting equipment, and the organization of fire fighting crews are worthy of the most active attention.

ADEQUATE FIRE DRILLS OF MEN IMPORTANT

10. Fire drills on the surface and underground should be conducted frequently and thoroughly. Those commonly conducted underground are pitifully inadequate and generally come at such long intervals and involve so few men that they are almost worthless. How many men in the average metal mines have an adequate knowledge of the location of escapeways and fire fighting equipment? How many receive intelligible instruction in these important items with sufficient frequency to retain it with any degree of accuracy?

11. "Second Exits" or escapeways are generally rendered useless when underground fires start in the intake air ways. The best chance that men have when trapped in this way is to bulkhead themselves in dead-ends and wait for rescue. Frequently splitting the air in the ventilating current reduces this danger.

12. Every deep metal mine should be equipped with an efficient means of mechanical ventilation by which the air currents can be reversed quickly, if necessary; and every such mine in which several levels are being worked simultaneously should have its air circulation divided into a number of splits.

13. Some provision should be made to give danger signals or "all out" signals to underground men. Every metal mine should be equipped to introduce a stench into the compressed air lines in cases of emergency, and a supply of the stench-making material should be on hand at all times. Such arrangements are easily made and are not expensive, yet may be

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the means of saving many lives, especially if all men are well drilled in their use.

14. Crews should be organized for effective between-shift inspections of timbered workings, shaft stations, airways, pump stations, etc.

15. Proper fire doors should be installed at strategic points to assist in the control of the ventilation.

16. The introduction of miners' electric cap lamps, and forbidding men to carry matches, flame making devices, or smoking materials would be an important item in the reduction of underground fire hazards. Of course if fuse is used for blasting, the men who split the fuse must be equipped with some type of flame making device. These suggestions may be regarded as somewhat radical now, but they are feasible and the time will come when they will receive thoughtful consideration.

DISCUSSION

Mr. Tillson opened the discussion by asking how low a percentage of oxygen must be maintained to stop the combustion of coal in a coal mine fire. Mr. Jacobus stated that in one mine he found that combustion ceased when the oxygen content was 7 per cent, but this fire had been burning only about two weeks, and had not heated the formation up to any great extent.

Mr. Tillson stated that is the discussion of flammability of volatile fluids at a session of the Engineering Section, a statement was made by Dr. Warren K. Lewis that volatile liquids like lacquer, shellac and alcohol would not propagate combustion if the oxygen content of the surrounding atmosphere was 12 per cent or less by volume, but in practice he preferably recommended 6 per cent.

Mr. Colburn stated that at the Sunnyside No. 2 Mine, the fire area was sealed and burned until the oxygen content was less than 4 per cent. He advocated the circulating of inert cold gases over the hot fire zone to lower the temperature of the coals.

Mr. Jacobus brought up the point of introducing air depleted in oxygen, into sealed off sections to extinguish a mine fire. He thought that a small fire in a large sealed off area is one of the hardest to contend with; he would rather have a large fire in a small area, and said there were cases on record where the fire had been allowed to increase in size so as to accumulate gases enough to smother it.

Mr. Goodale stated that he has had experience where a small fire has been left open until it increased in size and was then sealed, which extinguished it.

USE OF GAS ANALYSES IN FIGHTING FIRES

Mr. Tillson brought up the question of making gas analyses to assist in fighting fires. Mr. Gillette stated that the testing department of his company had gone extensively into the question of analyzing gases from fires, which was of valuable help in extinguishing fires. He mentioned one region where fire had been burning since the early '70's, and where it had been impossible to cool the area down. When the fresh air is ad-

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mitted, the fire starts anew, but will lie dormant when under seal, and there is a question in his mind whether this fire can actually be put out by a lack of oxygen. He said that places in this fire area are very hot, and other places had been coked in for probably 18 inches; but he does not think fire will travel through solid coal.

Mr. Jacobus said that at the Summit Hill fire he was informed that it was traveling through solid coal to a large extent.

Mr. Kudlich stated that he doubted whether the Summit Hill fire is traveling through solid coal, because in cutting away the coal barrier, they found the coal had fissured or broken, so that the gas traveled 40 or 50 feet through the coal, and he believed that the fire must travel through smaller fissures.

Mr. Johnson stated that at the Homestake fire they made regular gas analyses, but had been unable to seal the mine tight enough to put out the fire, and had to flood the mine.

Mr. Jacobus stated that in the selection of a proper place to take the analysis, it is better to get the air coming from the fire, which means more than the air back of the fire.

Mr. Charlton took exception to Mr. Wolflin's statement on swelling or slacking caused by water used on fires.

Mr. Goodale stated that in the Butte fires it was impossible to flood the area, because the water would rise so high that it ran into the adjoining property, and the fire has been a source of trouble by breaking out on account of settling ground and air getting to it. An effort had been made to put another fire out by drilling into it and running water on to the fire through the drill holes, but the water did not spread enough to reach the fire effectively. At the present time the company is endeavoring to fill up the burned section with flux from mill tailings, and expects to conquer the fire ultimately. Where stopes are filled with timbers and waste, it is almost impossible to get the waste up under the cap in such a way that it will prevent the fire from spreading along from timber to timber. It is almost impossible to seal such areas so as to eliminate oxygen, but the effort to fill the burning area with fine slimes will eventually smother the fire.

GAS EXPLOSIONS IN METAL MINES

Mr. Horace F. Lunt, State Commissioner of Mines, Denver, Colo., brought up the question of gas explosions in metal mines, stating that he had never heard of one of these explosions starting a fire. Mr. Ryan stated that several such explosions had been described in the Transactions of the Federated Mining Engineers, and they had been most frequent in South African Mines, one of which resulted in a fire.

In a discussion as to the merits of CO detectors, Mr. Jacobus stated that in one of their mines, some of the workmen had complained of headache and sickness. They tested the gases with the carbon monoxide gas detector and found a trace of carbon monoxide, which immediately made him suspect a fire. It was in an abandoned section of the mine, so the section was sealed and the air restored to normal.

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ELECTION OF OFFICERS

The meeting then took up the election of officers.

Benjamin Franklin Tillson was again elected chairman, and R. H. Seip elected secretary.

G. M. Gillette of the Consolidation Coal Company, was elected first vice-chairman; John L. Boardman of the Anaconda Copper Mining Company, was elected second vice-chairman, and William Connibear of the Cleveland Cliffs Iron Company, was elected third vice-chairman.

Mr. Tillson appointed the following committee chairmen:

1—Chairman of membership and publicity committee, J. T. Ryan, Vice-President and General Manager of the Mine Safety Appliances Company, Pittsburgh.

2—Chairman of program and publication committee, D. E. A. Charlton, Managing Editor, *Engineering and Mining Journal*, New York City.

3—Chairman of Standardization committee, Prof. R. M. Raymond, Mining Department, Columbia School of Mines, New York City.

4—Chairman of mine rescue, first-aid and contest committee, Orr Woodburn, Director, Globe-Miami District, Mine Rescue and First-Aid Association, Globe, Ariz.

CHAIRMEN OF SUB-COMMITTEES

3a. Accident statistics—W. W. Adams, Statistician, U. S. Bureau of Mines, Washington, D. C.

3-b. Ropes and safety devices in hoisting—Rudolph Kudlich, Assistant to Chief Mechanical Engineer, U. S. Bureau of Mines, Washington, D. C.

3-c. Mine hygiene and sanitation—Dr. R. R. Sayers, Chief Surgeon, U. S. Bureau of Mines, Washington, D. C.

3-d. Mine fire prevention and fighting—Joseph W. Reed, Safety Engineer, Consolidation Coal Company, Fairmount, West Virginia.

3-e. Mine haulage—Prof. H. H. Stoek.

4-a. Standardization of first-aid methods and rules for conducting and judging first-aid contests—Major M. J. Shields, American Red Cross, Washington, D. C.

4-b. Standardization of mine rescue training—D. J. Parker, Chief of Safety Cars and Stations, U. S. Bureau of Mines, Pittsburgh.

As a part of the program for the year, the chairman asked Mr. Gillette to take the responsibility for preparing a Safe Practices pamphlet on maintaining safety interests at mines. He stated Prof. Stoek had agreed to be responsible for preparing a Safe Practices pamphlet on mine haulage. Mr. Kudlich agreed to prepare a Safe Practices pamphlet on hoisting. Dr. Sayers agreed to prepare a pamphlet on mine hygiene and sanitation. Joseph W. Reed agreed to prepare a pamphlet on mine fire prevention and fighting. Dr. R. M. Raymond agreed to prepare a pamphlet on ropes.

Mr. Tillson read letter, from the American Institute of Mining Engineers relative to a session of the Mining Section of the National Safety Council to be held in conjunction with the February, 1922, meeting of the Institute, on mine ventilation and hoisting ropes and safety catches.

ADJOURNMENT.

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THURSDAY MORNING SESSION

AT the Fourth Session Vice-Chairman Johnson acted as chairman. The session discussed Maintaining Interest in Safety.

MAINTAINING SAFETY INTEREST AMONG EXECUTIVES

W. H. MOULTON, SECRETARY, AND WILLIAM CONNIBEAR, SAFETY ENGINEER, CLEVELAND CLIFFS IRON COMPANY, ISHPEMING, MICH.

The million or more men employed in the mining industry can well be gratified with the efforts being made by mining executives to reduce the hazards of the business and promote the welfare of their employees. If a study were made of industrial conditions for the past ten years no fact would stand out more convincingly than the enthusiastic support given by them to the promotion of safety. No greater advance in accident prevention has been made than in the mining industry. Mining executives early recognized the humane and economical value of safeguarding their workmen and there are few operators today who are not vitally concerned in this effort to reduce loss of life, physical disability and its consequent economic waste.

A very low accident rate has existed for many years in the mining industries of European countries, and executives of this country have realized that pride in our increasing efficiency could not be maintained unless we reduce the high rate of accidents. The mining executives have been fortunate in having the co-operation of the federal government through its Bureau of Mines, which has made careful investigation of the methods of mining, especially in relation to the safety of mines.

Though safety work has commanded the genuine interest and hearty co-operation of mining executives, and has brought about much improvement in working conditions, the annual accident records of the mines of the United States are not yet such as to justify a feeling of complacency. It may be considered well started, but the movement must continue to have the active support of executives and supervising officers, and that support must be constantly manifest. Needless loss of life and physical suffering of the injured, whenever they occur, always arouse generous impulses, but the continued presentation of facts is necessary to maintain an interest in safety. One of the most convincing arguments that can be advanced to maintain the interest of mining executives in safety work is the fact that in the mining industry alone there is an annual loss of three thousand lives, and there are a quarter million serious and slight accidents which result in a heavy economic loss and which may be materially reduced by safety work.

MORE ACCIDENT DATA NEEDED

Data covering the general costs of production is continually becoming more available and business men have readily made use of it. The records of many mining companies in accident prevention work during

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the past ten years provide data that should not be overlooked as it has such an important bearing upon the costs of the industry. The accident records of several large metal mining companies recently published show remarkably low accident rates for a six year period. There is still lacking, however, complete compilation of data from those many operators whose policy has been to spare no reasonable effort or expense to reduce accidents to a minimum, and the practicability of safety work has not been as thoroughly understood as it would have been had the data upon this subject been as accessible as other data having no greater bearing upon the cost of production.

The record of one large mining company may be referred to as an illustration of what may be accomplished in practical safety work. In the ten year period from 1911 to 1920, inclusive, the number of mines operated by this company varied from 18 to 23, located in the iron fields of Michigan and Minnesota. In 1920 there were employed 4,125 three-hundred day workers, and the annual average for the ten years was 3,116. During this time a number of new mines were developed, so the hazards encountered were not less than during the ten preceding years. A comparison of the average fatality rates for these two ten year periods shows that the annual death loss has been reduced one-half. If this same rate of reduction had prevailed throughout the coal and metal mines of the country, it would have resulted in the saving of 699 lives each year, or a total of 6,990 lives in the past ten years.

It must be realized that the problem of accident prevention is one not easily solved, and it has been determined in European countries, where the causes of industrial accidents have been given thorough investigation, that it requires from ten to fifteen years for a beginning. To illustrate the truth of this statement, 25 per cent of the fatal accidents which occurred during the last ten years were classified by one company's central safety committee as preventable, and if these preventable accidents had been avoided the annual rate of the company would have compared favorably with the low fatality rates that have prevailed in the mines of England and several European states for many years.

ECONOMIC SAVINGS THROUGH SAFETY

Workmen's compensation laws, which are now very general throughout the United States, have been enacted upon the principle that every workman who becomes injured in the course of his employment is entitled to some pecuniary payment for physical disability and loss of wages. The tendency in all of the amendments to the laws passed in recent years is to increase the benefits to the employees, and in some cases this increase is large. This economic burden of injury is not so slight that it will continue to be accepted as a necessary cost incident to production and shifted from the individual to the industry in which it is received, and through the industry to the general public.

When compensation laws were first enacted the insurance companies, having no satisfactory data available, were obliged to place upon the mining industry a high premium rate, and though these rates have been

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materially reduced in recent years, many operators, carrying their own risk, have found that a strong continuing safety policy has enabled them to carry the risk at much less cost than if insured at the lowest rates quoted. Since the compensation law was enacted in Michigan in 1912, and a year later in Minnesota, the accident cost of the mining company above referred to has been 38.98 per cent of the lowest rate quoted. During this nine year period the average saving per year amounted to $76,800. If the same reduction in accidents had been made throughout the mining industry of the United States,, using the same average wages for a basis, the annual saving to the industry would have been $19,500,000 in compensation cost alone.

The experience of a single operator may not be broad enough to afford a working basis for so large an industry as mining, but it should be within the province of the service engineer of the Mining Section of the National Safety Council to secure and compile all available data so that mining executives may have this information constantly before them.

ORGANIZATION OF A SAFETY DEPARTMENT

In the organization of a safety department one of the essentials is the central safety committee whose function is to act as a legislative body upon safety devices and recommendations, to study all accidents, and to properly classify them by causes. This committee should be composed of men in executive positions whom the chief executive holds responsible for the conduct of the business. Safety work is thus looked upon as a members and arouse more activity in safety work—each member will be part of the business of the organization, and not as an intangible element of the industry that cannot be solved. Frequent visits of the chief executive to the meetings of the committee will stimulate the interest of the anxious to maintain as favorable an individual record as his associates. The proceedings of each session should receive the signature of the chief executive to indicate their importance and to make them official.

A fatal accident should be regarded of such importance as to command a special investigation by competent men so that, if possible, plans may be adopted to prevent a recurrence of a similar accident. This committee should be composed of three subordinate executives whose duties would cover an inspection of the place where the fatality occurred, and the recording of the testimony of witnesses to the accident. A report of its findings should be made to the chief executive, and in case of a preventable fatality the report should indicate the responsibility for the accident and contain the recommendations of the committee. When their time must necessarily be spent in investigating and remedying the causes of accidents, these executives will be more interested in the accident record of the men under their personal supervision and thus disposed to give more attention to the enforcement of the safety policy of the company. Each investigation will bring most forcibly to the minds of these men the continuing need of hearty co-operation in all safety work.

The safety engineer and the members of the foremen's and workmen's

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safety committees are important agencies in maintaining the interest of executives. They must, however, be given the responsibility of making complete and detailed reports of actual working conditions. Their work should be thorough, and undertaken with the idea of helpfulness in reducing danger to their fellow workmen and themselves. When undertaken in this spirit, their reports will be considered as helpful suggestions rather than criticism, and be regarded as trustworthy by all executives and operating officials.

Much depends upon the safety engineer. He should be a man with a thorough knowledge of mining methods, be alert to see dangerous conditions, have the ability to work with other men, which presupposes a reasonable mind. He must have a full realization of what accidents and lost time mean to the industry, and a strong sympathy for the men upon whom the suffering and much of the pecuniary loss falls. With these characteristics, and an ability to present his reports and recommendations in a satisfactory form, he will contribute very largely to the interest of the executive in all safety matters.

A well defined safety policy, consistently worked out, will enable an executive to feel the same degree of satisfactioon in safety work as in all other features incident to production. Safety work must be recognized as a valued asset, no longer an experiment but an important factor in every well organized business.

SAFETY ORGANIZATION AND METHOD OF OPERATING AND MAINTAINING INTEREST AMONG SHIFT BOSSES AND FOREMEN

THOMAS COWPERTHWAITE, SAFETY INSPECTOR, CALUMET AND ARIZONA MINING COMPANY, BISBEE, ARIZ.

In February, 1915, Col. J. C. Greenway, Manager of the Calumet and Arizona Mining and Allied Companies, was determined to organize a safety department in order to reduce the injuries occurring to workmen. Thomas Cowperthwaite, a member of the engineering department, was appointed safety supervisor, with instructions to form an organization.

After a thorough study of conditions existing throughout the various mines and plants operated by the Calumet and Arizona Mining Company, Mr. Cowperthwaite saw that it was impossible for a supervisor to reduce accidents without full co-operation of the various shift bosses and foremen and superintendents. At this time many of the shift bosses and foremen considered safety work a joke. It was necessary to arrange a system whereby those who considered it as such would finally get caught in their own trap. To overcome the above difficulties, the organization was formed in the following manner:

Mr. Cowperthwaite and his secretary comprised the safety department. All shift bosses, foremen, and superintendents were safety committeemen, each being held absolutely responsible for the men working under him and for all accidents happening under their supervision, whether purely

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accidental, through carelessness of the workmen, or owing to bad conditions. This gave the safety supervisor a chance to arrange data and reports which would finally catch the careless bosses in their own trap and determine whether or not they were capable of performing their duty in regard to preventing accidents.

HOW THEY WERE SHOWN SAFETY WAS NOT A "JOKE"

Monthly meetings were then held, with the mine superintendent presiding. The safety supervisor reported all accidents which had happened during the previous month, stating clearly under whom they occurred, the nature of the injury, and a solution, if possible, as to how they could have been prevented. All bosses had to attend these meetings or give the safety supervisor a satisfactory excuse for not attending. These meetings were of great benefit to the safety supervisor, because the bosses who considered the safety movement a joke had to sit among their fellow workmen and be criticised either directly or indirectly by the safety supervisor, the mine superintendent, and often the general foreman, for not being capable of reducing their accidents as the other bosses were doing. They began to see that accident prevention had become a part of their duty as much as getting out a certain tonnage.

It may appear to some that this system of getting co-operation is false, but those who have studied human nature and understand how to handle men know that it is almost impossible to handle a large crew of bosses and have a certain extra duty performed by them, unless there is authority to demand its performance or some system which in time will create its performance. Many bosses felt that they had sufficient work to attend to without having this extra duty imposed upon them. The answer to this was—"Use system, as the safety department is doing with you, and each man will attend to his own safety work—you will have to do only the inspecting, which must be done regardless of a safety department."

In order to help the bosses train their men to be careful, the safety supervisor inaugurated a rule that any man found working under unnecessary bad conditions must be laid off for from two days to two weeks, according to the condition. This rule was very effective and but very few men had to be laid off in order to teach the others.

The safety supervisor spoke to the men at various times just before they went to work and told them he was to blame for the lay-off system, and they should not blame their bosses if they happened to be laid off for not taking care of themselves, but that we were going to prevent them from being injured. They were also told what they were expected to do to help in the movement, and that they were to notify the safety supervisor secretly of any condition they thought was bad, and he would attend to it unknown to anyone who had authority to discharge them for their act.

HOW IT WORKED OUT

In a very short time both workmen and bosses knew the safety department meant business, and that excuses for having accidents were not considered. This resulted in the fact that every boss and foreman was

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willing to co-operate with the safety department. Experience has taught us that in many cases co-operation cannot be depended upon until it is shown by some forcible system that proper results can be accomplished. If good results can be shown in this way, it is not hard to get a man's co-operation, for he has actually been shown that he is capable of performing a duty which he had previously considered impossible. After he once succeeds, his interest grows more intense, until finally this duty becomes as a mechanical operation and is efficiently executed.

BONUSES FOR GOOD SAFETY WORK

In order to create interest and have it continued, all shift bosses and foremen of the various mines are kept in competition with each other and a monthly report is issued showing their standing for the month in question, and also their standing to date for the year. A bonus of $30 is paid to the shift boss who can work his crew 2,500 shifts without any of them losing more than one day on account of injury. The foreman with the best yearly record is paid $100.

A serious accident is one requiring the man injured to lay off 14 or more days, and a minor accident one that causes a loss of less than 14 days. Percentages are figured on a 1,000 shift basis, and 25 points are deducted for a fatal accident, if caused through any neglect of the shift boss or foreman, and 12 points deducted if caused through carelessness of the employee. Six points are deducted for any serious accident and one point for a minor accident. No-time-lost accidents are not figured against a shift boss or foreman directly, but are figured against the mine in the monthly report of total accidents per thousand shifts worked.

Allowing a shift boss one day in which to get his man back to work has proved very effective during normal times. A number of men who receive only a slight scratch make it an excuse to lay off four or five days. Under this system the boss is anxious to maintain his record and win $30, so he talks the man into coming to work without losing any time, providing the injury is slight enough to justify it.

UTILIZING CONVALESCENT MEN

Another very beneficial system for accidents which would be likely to cause loss of fourteen days or more is to allow the injured man to return to work as soon as possible and give him some light work which he is capable of performing until he is able to go back to his regular work. Cleaning track, attending to powder magazines, etc., are duties such men can perform. This work must be done by an able-bodied man if not by one who has been injured, and is beneficial to the employee, as he receives his regular wage, and under our compensation law he would receive only half-pay should he lay off fourteen or more days, and no compensation for less than fourteen days. It also keeps the man satisfied, which is necessary for efficient operation. In all such cases the injured man must appear at the doctor's office each evening and have the wound dressed.

The safety supervisor makes regular trips underground, and, unless

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there is some special work to do, he always goes with a shift boss and inspects his portion of the mine. In case any bad condition is found, the shift boss is asked to have it fixed. If the shift boss considers he has not authority to repair the condition, he takes it up with the foreman, who either gives him authority or consults with the safety supervisor. It is bad practice to complain to the foreman of any bad condition found if the shift boss has authority to overcome this condition. This, of course, is only in case a shift boss is willing to overcome his own errors. Otherwise the foreman should be notified. By treating a shift boss in this manner he takes interest in satisfying your demands, and the foreman is also interested in having details attended to without his having to be burdened with them.

By using a competitive system for safety work, one supervisor and a secretary can handle a large number of properties and obtain good results, providing he has the proper backing by the general manager and superintendents, and sufficient authority to handle the work. The safety supervisor must not be anxious to show his authority, however, unless absolutely necessary. He must know how to handle dangerous ground, and be able to detect whether or not ground is dangerous. He must remember he is dealing with men who are experienced in this work, and mistakes will cause men to lose their confidence in him.

The record shows a decrease of 55.4 per cent since the organization of the safety department, and the serious accidents at the present time and for some time past are very slight compared to those of the year 1915, when the department was organized. Accidents now consist principally of bruised fingers and toes.

(Chairman Johnson read the paper prepared by N. D. Hubbell, entitled, "Getting the Safety Message to the Individual Miner." This paper should have been presented at the Ninth Annual Safety Congress in Milwaukee, but had not been, although it was published in the 1920 Proceedings and can be found on page 777.)

MAINTAINING SAFETY INTEREST AMONG MINERS

John T. Bradley, Safety Engineer, W. J. Rainey, Inc., Uniontown, Pa.

Successful safety work among miners begins with mine officials at the time miners are employed. It is part of the business of the officials to instruct, and to see that their instructions are carried out.

The official who is on the job regularly and who visits the miners several times daily should properly instruct the miners during these visits in such a way as to stimulate interest in safety. The manner of approach and tone of voice when addressing a miner can be made a stimulus to prevent accidents. If the official is in the habit of approaching a man in a gruff and harsh tone of voice, the man naturally becomes disheartened and careless due to the fact that he resents the official's visit. The official should be something of a psychologist and understand

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each man's weakness. He should approach a man and address him pleasantly. Then the miner looks forward to the official's visit and always keeps his working place safe and efficient so that the official will commend him. I never saw an official who was cold and indifferent who could get his men to work with him and keep them interested in safety. The official who is able to keep his men on the job is efficient and able to reduce accidents by reducing the labor turnover.

In order to stimulate interest it is necessary to make the miner see where the mistakes are, and to distinguish between the right and wrong way of doing things. Most miners are foreigners who are more or less ignorant of the English language. They require guidance in the matter of protecting themselves. It is an established fact that the careful worker is as a rule the most efficient. Training and education are necessary for safety and efficiency. Experience is the best of teachers, but the risk involved in permitting the inexperienced miner to pursue his own method is too great. A miner should possess knowledge that will enable him to work in comparative safety when left to his own resources.

SAFETY SUGGESTIONS

In the maintaining of safety interest among the miners it is necessary for the officials to gain the confidence of the miners sufficiently to accept and put into force any and all safety suggestions that the miners have to offer. During the official's visit if he should find a miner violating any of the safety rules, he should be cautious in approaching the miner and not lose his temper. He should approach the miner in such a manner that the safety suggestions he has to offer will be of much benefit in maintaining safety.

SIGN BOARDS IN THE MINE

All new workmen should first receive instructions from the official who employs him or through an interpreter. Afterwards he should be placed in the hands of a competent man who can talk to him in the language which he understands best. This is for the purpose of showing the man to his working place and warning him of the dangers to and from his working place which are apparent only to experienced workmen.

The miner's attention should be called to all danger signs, notices and warnings, guarded and unguarded trolley wires, crossing signs showing the proper traveling ways both in and out of the mine; also, the proper way to get in and out of the man-trip, and the dangers he is likely to encounter should he attempt to leave the trip before it stops. When he reaches the working face he should be instructed in the safe and proper methods of working. He should receive practical instructions in testing the roof and how and when to set timbers to protect himself. He should be taught the necessity of blocking cars to prevent them from running away and injuring himself or others.

PRIZES

In order to maintain interest I would suggest that a bonus or suitable prize be given to each miner who at the end of each half year has not

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received an injury entailing loss of time, for every accident, serious or trivial, causes lost time and demoralizes and disorganizes the working force and thus affects the output and the profits. Maintaining safety interest reduces accidents, increases output and profits. It produces a better feeling on the part of the employees.

ENTERTAINMENTS TO BOOST SAFETY

Safety interest among miners can be maintained by providing forms of amusement where the miner and his family can be present together for a few hours weekly. This amusement, where local talent is available, can consist of a concert, with a forceful speaker to speak for a few minutes on safety and safety devices. Another form of amusement to maintain interest is to have free moving picture shows weekly in some building, or outdoors in the summertime. These free picture shows should consist of a few reels of drama and comedy, and a few reels of safety pictures showing the right and wrong method of labor. Then the family would take occasion to remind the father of the dangers surrounding him in the mine and caution him to be careful.

BULLETIN BOARDS

The bulletin board should be made as attractive as possible in order to create an impression on the minds of the miners when passing it. The pictures exhibited on the bulletin board should show how men are injured and how accidents could have been prevented. These pictures should be changed every week. If there are no more pictures on hand to replace those taken off the bulletin board, let the board remain empty. Another method of keeping up interest is to have bulletins in the form of postal cards sent to the homes, showing how men were injured and how the accident could have been prevented.

SUGGESTION BOX

Still another method is to have a suggestion box fastened up in some convenient place to receive suggestions relative to safety and give a prize each month for each safety suggestion that is put in use. Monthly meetings should be held where the miners can be present to hear the suggestions and recommendations.

INSPECTION TRIPS

Inspection trips of miners in company with the mine officials cultivate the necessary spirit of enthusiasm and co-operation. The inspection trips acquaint all workmen with the endeavors for safety, and every man knows that special effort is being made to reduce accidents.

DISCUSSION

Mr. Cowperthwaite recommended that the safety inspectors make inspection trips regularly with the shift bosses. Mr. Seip stated that while he does not make regular inspection trips, he always makes it a point to go

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with the shift boss when inspecting his particular section of the mine. This is done in order that the shift boss may know first hand the conditions that are considered bad, and keeps him from getting the idea that the only thing the safety inspector can do is to find fault. Mr. Seip prefers to fight his safety ideas out with the shift boss first.

Mr. Charlton agreed with Mr. Seip, stating that when a shift boss is taken on the trip, it relieves him of the suspicion that you are trying to investigate him, and does away with any prejudice, and promotes co-operation. There is a distinct advantage in nailing a thing at the time you find it.

Mr. Johnson stated that he goes along with the shift boss at the time of making his trip, but makes additional trips to see that the conditions have been rectified.

BONUSES

The question of bonuses was then discussed. Mr. Thomas Hubert of the Commonwealth Steel Company, Granite City, Ill., stated that he had taken the head of a mushroom chisel and took several burrs from it, fastened them to a piece of cardboard, and offered a prize of $1 each for the first five correct answers to the question, "What are they and where are they from?" Five correct answers were received out of thirteen.

Mr. Seip stated that at the New Jersey Zinc Company a shift boss having no lost time accidents (entailing one day or more loss) during the month, receives a $5 bonus each month in the year. Semi-annual bonuses of $20 are given each shift boss whose lost time accident rating is less than five-tenths of an accident per one thousand 8-hour shifts. Also, an annual bonus of $20 is paid for a similar rating for the entire year. Still another bonus of $20 is paid if the amount of lost time for the entire year is less than four-tenths of 1 per cent of the total time work by the shift boss's gang. This system gives an opportunity to get a total in bonuses of $140, and it has worked out satisfactorily.

Mr. D. P. Kennedy, Safety Engineer, Pittsburgh Plate Glass Company, Pittsburgh, felt that such a bonus system would have a tendency to get the man back to work in order to pad the result.

Mr. Tillson thought that the paying of bonuses was a splendid means of keeping the safety idea before the foremen at all times. It is really an advertising campaign. It is not so much the value of the bonus, as it is the fact of it. Before the war, the New Jersey Zinc Company offered cigars to the gang of men who were free from accident for a month. Special cigars were provided with special wrappers and special insignia. It was interesting to notice how the fellows who went around smoking these cigars would crow over their fellow workmen. When this idea was first proposed, some men said, "Why would a man protect himself from accident to get a cigar, when he is saving himself from pain, loss of time, loss of income?" It seems foolish, but the fact remains that there is an element of competition in the reward that interested the men and kept safety before them.

Mr. Charlton asked what come-back has a foreman or shift boss if

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several men under him took it in their heads to knock down his record. Does the foreman or shift boss have the say as to what man he takes on and what man he lets go, or is that up to the man higher up?

Mr. Matt Stevens, shift boss for the New Jersey Zinc Company, stated that he knew of no case where the men worked against the shift boss in that way, and Mr. Tillson corroborated this fact.

Mr. Kneeland told of one case where a small bonus had changed the attitude of the workmen. One German expressed it very well when he said, "Vell, by golly, now I know dey mean sometings ven dey talk money to us," and after that the safety movement was no longer considered a joke. Mr. Kneeland mentioned another case in Newfoundland where a small bonus was offered. The paymaster would pay the regular wages in the usual way, but would pay the bonuses in gold coin. The men were so pleased about getting these gold pieces that it kept the mine management busy hunting through the country to keep a supply of gold pieces ahead with which to pay the bonuses.

Mr. Frank E. Harr of the Clinchfield Coal Corporation, Dante, Va., stated that his company had organized safety committees of a size proportionate to the size of the mine. Each committee has a chairman, and the committee is called together regularly to discuss problems that come up. The committee's report goes to the mine foreman, who sends it to the superintendent. The company pays $2.50 for each safety suggestion that is approved and adopted. The assistant foreman receives $5 each month for a clean accident record, and the general foreman receives $10 for a clean accident record. The company also gives a trip to the annual Congress of the National Safety Council to those having the best record for the year, from September to September. These trips to the National Safety Council help a great deal in maintaining interest. It was noted that the Clinchfield Coal Corporation is always well represented at the Mining Section meeting with men who have good judgment in matters of safety.

Mr. J. M. Bailey of the Clinchfield Coal Corporation, stated that it is not a question of money with them, but that they wish to reduce accidents, and to do so, they felt it important that a good representation of their men be present at the annual Congress of the National Safety Council. This bonus system therefore, insures that the best men are sent to the meetings. Mr. Bailey felt that the dark side of the bonus feature comes in padding. For instance, a man gets a scratch which is only a little one at first, and he is told not to go to the doctor because it will then ruin the foreman's safety record and he will lost the bonus. In one instance in his mine, the foreman persuaded the miner not to go to the doctor for a scratch, and infection took place. After that the $5 bonus was discontinued.

Mr. C. W. Goodale stated that the Anaconda Copper Mining Company attempted a bonus system in which $750 was given to the foreman having the best record, and $250 was given to the foreman having the second best record. It was very hard to award these bonuses, because the foreman with a large number of men had a larger accident risk than the

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foreman with a small number of men. For that reason, the foremen with many men lost interest, because the little fellow was sure of winning the prize. After four years' trial, the bonus was dropped.

The workmen's compensation law of Montana provided that men draw accident compensation for disability of more than fourteen days, so that period was adopted as the minimum. In some cases, the foremen were accused of chasing the men out of the hospital within the fourteen days. Cases are also on record where certain shift bosses would state that they did not want a certain man because he was careless, and would ruin their chances of winning the bonus, so the man would be laid off. Such cases complicate the bonus system. To arouse rivalry amongst the foremen, a list of the accidents were printed every month in the "*Anode*" (a safety journal printed by the company), and an honor column was established for the mines that worked 15,000 shifts with no accidents that would disable a man for more than fourteen days. It was found that the foremen watched the column and tried to keep as near the top as possible. Mr. Goodale also referred to the bonus system employed for a number of years by the United States Coal and Coke Company, under which system fatalities were reduced from one per 100,000 shifts to one per 500,000 shifts.

Mr. Tillson stated that he thought the difficulty with the Anaconda system was that the number of fatal and permanent disability accidents is so limited that it is hard to strike an average on which to pay the bonus. By carrying the accident rates to include all injuries causing loss of time a much more extensive record can be kept, and the proper balance can be had between the man with the big gang and the man with the small gang. At one time his company tried the scheme of paying a lump sum for the two highest men, but found the system unsatisfactory. Mr. Tillson thinks it far better that the reward be commensurate with the results accomplished, instead of one man having all the luck. A man that does excellent work for a period is gratified if his efforts are appreciated and rewarded.

PHOTOGRAPHS OF UNSAFE PRACTICES OBSERVED

Mr. Goodale told of a scheme tried by the North Butte Company in which the safety engineer takes with him a little photographic outfit, and as he goes through the mine takes flashlights of anything that is unsafe At the meeting of the foremen every week, the pictures are thrown on the screen and a laugh is had on the particular foreman whose pictures are shown. As one of the greatest hazards is that of men falling into vertical chutes, grizzlies have been placed over the top of the chutes so that the men can not fall through, and large pieces of rock have to be broken before they will go through the grizzlies. In one of the pictures, a miner was shown straddling the chute, pulling the grizzlies off, so he could get a big rock down. He was removing the thing that was placed there for his own safety.

Mr. Tillson brought up the question again of the co-operation between the safety inspector and the foreman, stating that it is one of the hardest problems with which safety men have to contend. There is a lot of

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prejudice, the foreman feeling that the inspector is a nuisance, and he does not like to see him around. Probably the best way is for the mine management to tell the foreman that the inspectors are put on to help them, rather than to get them into trouble.

Mr. Seip expressed the thought that one of the main causes of difference between the safety inspector and the foreman is that they do not get to know each other well enough.

Mr. Colburn brought up the advantages of having inspections made by a committee of miners. It is difficult to take men from contract work to make inspections, but men working on day's pay are glad of the diversion. It is one of the best ways to educate the miner to safety measures, and affords an opportunity for the man to voice any complaint regarding his working place. Mines that are working this system seem to be profiting not only from the value of the inspection and safety education given the miner, but also from the many worth-while suggestions made by the miners.

Mr. Tillson requested Mr. Gillette to circularize the members and mining companies throughout the country to determine what others are doing to promote and maintain interest in safety in their organization.

Following the discussion on maintaining safety interest Mr. Tillson told again of the co-operation with the United States Bureau of Mines and introduced Mr. F. J. Bailey, Assistant to the Director, United States Bureau of Mines, Washington, D. C., as the man who saw the advantages of the co-operation.

Mr. Bailey spoke briefly of his interest in the success of the co-operation. The Bureau of Mines was organized to serve the public and was particularly charged with the promotion of safety in the mining industry, he said. Not only is the Bureau willing to furnish the services of Mr. Colburn, but will contribute the services of other Bureau of Mines men if it can be shown that safety or accident prevention can be materially increased, he declared.

Mr. C. L. Colburn was then called upon, and presented his paper on "Observations of a Safety Engineer in Various Coal and Metal Mining Camps of the United States."

(Since it is planned to reproduce most of this paper in special articles for the *National Safety News* only a brief outline of it will be given in these transactions.)

ABSTRACT

The safety organizations of several miners were first discussed. The earnest desire of a great many operators to reduce accidents was brought out, and the importance of giving the companies' safety engineers unstinting support, and the carrying on of an aggressive safety campaign were emphasized.

Mr. Colburn then discussed the difference of opinion of the operators as to what was safe and unsafe practice, and urged that more operators attend the annual Congress of the National Safety Council when such problems are discussed.

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The difficulty of preparing safety bulletins that are equally valuable for all mines was mentioned and it was shown that specific bulletins had a narrow range of usefulness, because the mines are all so different.

Views were shown of surface plants to bring out the advantages of keeping the plant up, and how grass and trees will add to the attractiveness of the plant and the contentment of the men.

Photographs were shown of passageways from change house to the mine so as to protect the underground men from the weather on coming off of shift. Photographs were shown of man cars and how they are used, of an arrow painted on the rib of a coal mine to lead the miners to the surface,

PART OF SURFACE PLANT OF NEGAUNEE MINE, CLEVELAND CLIFFS IRON COMPANY, SHOWING HOW A LITTLE GRASS AND CARE WILL MAKE AN ATTRACTIVE AND DESIRABLE PLACE IN WHICH TO WORK.

of the danger of men riding on the rim of a skip, of the safety advantages of bin and skip pocket, of the leading methods of signaling the hoist engineer from stations and from moving cages, of fire proof pump stations, of chutes with guard rail, etc.

The arrangement and upkeep of several modern change houses were discussed, and the safety and health campaign being conducted by the Industrial Commission of Utah was fully described as follows:

SAFETY AND HEALTH CAMPAIGN IN UTAH

This campaign was started January 16, 1921. At least two weeks are spent in each of the important metal and coal mining camps of the state. The campaign is advertised for a week or more before the arrival of the mine rescue car of the Bureau of Mines. The campaign opens with a safety and health rally at the local hall or moving picture theatre. A prominent local official is asked to preside at the meeting. Moving picture films on safety and health are shown, and addresses are made by members of the crew and officials of the state. A children's rally is held and all

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children of the camp are given pledge cards to sign. This pledge card serves two purposes—first, to center the thoughts of the child on his own safety and health; and second, to secure the interest of the parent or other wage earner of the family. At a later meeting when the child returns the card fully signed, he is given a safety and health scout button. Literature on health subjects is furnished the teachers of the schools in the camp for use as lessons.

The second evening a foreman's meeting is held, which all the operating mine officials, foremen, assistant foremen, mine captains, shift bosses, fire bosses, master mechanic, chief electricians, and outside foremen are invited to attend. The meeting opens with the display of a number of lantern slides of the safety bulletins of the National Safety Council; then short addresses by one or more members of the state mine inspection de-

U. S. Bureau of Mines Rescue Car at Mohrland, Utah, During Safety and Health Campaign.

The men are (from left to right) Mr. Carrick, Car Engineer (in charge of Car); Mr. C. L. Colburn, Safety Engineer, U. S. Bureau of Mines and National Safety Council; Mr. John Crawford, State Coal Mine Inspector, Utah; Mr. Lutz, Foreman Miner on Car; Dr. A. L. Murray, Car Surgeon (Passed Assistant Surgeon, U. S. Public Health Service); Mr. Hart, Car Clerk; Mr. Morrison, First-Aid Miner on Car; and Mr. Martin Acosta, Car Chef.

partment and a free-for-all discussion of safety rules, regulations, and practices. At this meeting the accident experience of the mine or mines of the camp is discussed with a view of seeking remedies for their prevention. Following the foreman's meeting, classes are organized throughout the district for first-aid training and mine rescue training.

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Mr. Tillson outlined the scope of Mr. Colburn's services, and asked for suggestions as to how they might best be utilized by the members.

Mr. Charlton suggested that mining executives be especially urged to attend the next Congress. He also made a plea for more use of the *National Safety News* to disseminate information on safety in mining.

Mr. Reed made a plea for more complete statistics on accidents, especially in coal mining, and thought that an analysis of the accident statistics would be especially valuable to the industry. Then followed a general discussion of accident statistics, and Mr. Bailey was asked to use his influence to persuade the Bureau of Mines to collect more complete statistics. Mr. Bailey told of the difficulties of collecting complete statistics from the coal mines but promised to try to work out a plan.

ADJOURNMENT.

FRIDAY MORNING SESSION

MR. TILLSON presided at the Fifth Session, at which the subject of Safety, Health, and Sanitation, in Mines was discussed.

TRAVELING WAYS AND SIGNS

By R. H. Seip, Safety Engineer, The New Jersey Zinc Company, Franklin, N. J.

Traveling ways, as defined in this paper, do not include those in which mechanical transportation is involved, but rather walking ways, such as gangways, entries, drifts, slopes, raises, shafts, etc. including stairways and ladderways.

The mining laws of most states require that mines of any appreciable size shall have at least two openings to the surface. This, of course, is good practice, as there may be a sufficient number of traveling ways leading to one or both of these openings so arranged as to make practically certain the escape of all men in case of accident in any one section of the mine. Frequently, however, it is essential that more than two openings be provided, especially if the shaft or opening used for hoisting does not contain a ladder compartment or traveling way for men. Flammable structures erected over such openings create a hazard which is especially undesirable.

In order that the best practice may be adhered to all main traveling ways should extend to the farthest parts of the mine and be as continuous as possible. This is not always practicable, as local conditions or methods of development may make it impossible. It is desirable from the fact that miners are prone to move about from one mine to another, and thus are not as familiar with the location of traveling ways as are the bosses and officials.

It has long been considered good practice to have traveling ways for men independent of haulage ways wherever possible. This is especially

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true where mechanical haulage is employed, as on levels or entries with electric haulage motors and on slopes with rope haulage. There are comparatively few places where traveling on slopes by men cannot be avoided.

Local conditions, such as height of roof, haulage roads, mine atmosphere, systems of ventilation employed, etc., may render the use of haulage roads as traveling ways for men necessary. Where this is the case the drift or entry should be of sufficient width to permit men to pass

FIGURE 1.

moving trips safely. At one large metal mine in a heavily timbered haulage drift the traveling way is divided from the haulage road by additional timber legs set about one-fourth of the distance from one side of the drift to the other side, as in Figure 1.

Another large coal mining company maintains its traveling ways on the same side of the haulage road throughout the mine. It is common practice, where the haulage drift or entry is so narrow that a traveling way cannot be made on one side, to provide refuge holes in the sides at frequent intervals. Sometimes these are painted white or whitewashed, especially in coal mines, in order to be easily distinguished, or they are

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marked with a light. In one case where these refuge holes are located along the haulage way, they are indicated by means of a blue light. Inasmuch as a blue light does not conflict with the colors generally used for other signals, it would seem to constitute an acceptable method of indicating such places.

INCLINED AND VERTICAL TRAVELING WAYS

The foregoing paragraphs refer principally to traveling ways which are practically level. There are, however, many inclined and vertical traveling ways to be found throughout the country, principally in the anthracite mines and metal mines. Slopes, shafts, winzes, raises, etc., all are to be found used as traveling ways. Assuming that such openings are of sufficient size, the method of travel in such passages will be considered.

Where the floor is not of a slippery character and the inclination not greater than 25° to 30° from the horizontal, it will probably be unnecessary to install stairways. For inclinations over 20°, however, hand rails should be installed.

STAIRWAYS

For inclinations of from 30° to 50° from the horizontal, stairways constitute safe practice. A width of at least 24 inches should be employed, with hand rails 42 inches in height, measured from center of tread. The relation between the height of risers to the width of the treads is important, and Safe Practices pamphlet No. 2, "Stairs and Stairways," states that "a safe practice is to make the tread and riser combined about 17½ inches, the width of the tread slightly exceeding the height of the riser." This relation is practical up to an inclination of 45°. Beyond that inclination the width of the tread necessarily becomes less than the height of the riser. The following rule for calculating the proportional width and height of treads and risers is taken from the same Safe Practices pamphlet and is the standard used by the United States Steel Corporation:

$$\frac{25'' - \text{width of tread in inches}}{2} \text{ equals riser in inches.}$$

Stairways having an inclination of less than 40° may be unbroken in length if platforms are placed at frequent intervals to provide a place to rest. Where the inclination is greater than 40° it is advisable to break the continuity of the stairway, and provision should be made in this case for the convenient passage of stretchers from flight to flight.

LADDERWAYS

When the angle of inclination exceeds 50° from the horizontal, stairways no longer constitute safe practice, and ladderways should be installed. Such ladderways may be continuous up to an angle of 80°, but should be provided with platforms or sollars not over 50 feet apart, having openings large enough to permit passage of men or stretchers.

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For inclinations of from 80° to 90° ladders should be staggered, and each ladder should not exceed 25 feet in length with platforms at each point where changes are made from one ladder to another. In all such cases the ladder should extend at least 3 feet above the platform, and the openings be protected by railings. Under no circumstances should a ladder be installed to incline backward from the vertical. If it is not practicable to have ladders extend above the platform, convenient and secure handholds may be installed.

CONSTRUCTION OF LADDERS

It is of utmost importance that the ladders throughout a mine be of uniform construction as regards width, distance between rungs, materials, and methods of installation. The daily inspection of all ladderways is of equal importance.

MATERIALS

In deciding upon the materials to be used in the construction of ladders, the conditions under which they are to be used must be given consideration. Ladders used on the surface can be kept dry, while those used in the mine are subjected to dampness almost continuously. For this reason a ladder of iron construction throughout, both sides and rungs, would probably constitute the safest ladder. Further, hobnailed shoes, such as are worn by most miners, make the use of iron rungs practically a necessity. Ladders constructed entirely of iron make the cost of construction almost prohibitive, although the cost of maintenance is comparatively low.

Figure 2 illustrates the type of ladder which has been adopted by one company as standard. This type of ladder has practically all of the advantages of an all metal ladder, yet the construction cost is much lower. It will be noted that the side pieces are of oak or chestnut 2"x4"x9'0", while the rungs consist of ¾" wrought iron pipe. This

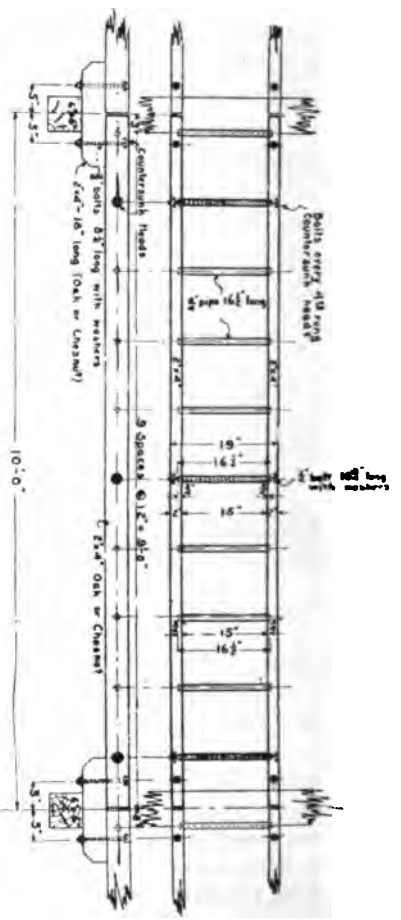

FIGURE 2.

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construction has proved to be entirely satisfactory from the standpoint of both cost and safety. The ladders are made in various lengths for convenience in handling and installation.

WIDTH OF LADDERS

The width, or distance between side pieces, should be sufficient to permit traveling without danger of stepping off side of ladder, yet should not be too wide so as to weaken the rungs. In the sketch referred to, the distance between the side pieces is 15 inches. This distance is satisfactory not only for general travel purposes, but also for the handling of stretchers, especially the navy or basket type.

DISTANCE BETWEEN RUNGS

Whatever distance between rungs is accepted as the standard for any mine, such distance should be rigidly maintained. Variation of more than one inch in any ladder should not be permitted. For this reason inspection of ladders should be made daily for bent rungs which should be replaced or straightened immediately.

Distances from 10 to 14 inches are generally used and constitute safe practice. Figure 2 shows a distance of 12 inches between rungs which gives very satisfactory results. It will be noted that the rungs are 16½ inches in length. Holes ¾" in diameter and ¾" in depth are drilled in the side pieces and the rungs are inserted in these holes. Every fourth hole is drilled through the side pieces ½" in diameter. A bolt ½"x18¾" passes through these holes and through the rung at that point. The heads and washers of these bolts are countersunk on outer side of ladder. By this means the sides are securely tied together at these points.

METHODS OF INSTALLATION

A safe method of installation is an essential as a safe method of construction. First, sufficient clearance between the ladder and the back of the raise or shaft is important and should not be less than 30 inches. Second, at least 3 inches clearance should be maintained between the ladder rungs and the underlying wall or timbers. To obtain this clearance, to securely connect the separate ladders, and to fix them safely in the raise the following method is employed in the standard ladder referred to in the foregoing paragraphs.

A piece of oak or chestnut 2"x4"x18" is securely bolted to each side of the ladders at the point of connection by two ⅝"x8¼" bolts, the long section (4") of the 2"x4" being perpendicular to the ladder (see Figure 2). These pieces are, in turn firmly spiked or bolted to cross sills 6"x6" also of oak or chestnut, firmly set on the underlying wall or timbers.

There should be no change of grade in any continuous ladder way. Wherever it becomes necessary to change the degree of inclination a landing platform should be installed with another opening to the next ladder.

UNDERGROUND SIGNS

If it were possible to have all traveling ways and exits continuous or in alignment throughout the mine the matter of direction signs would be

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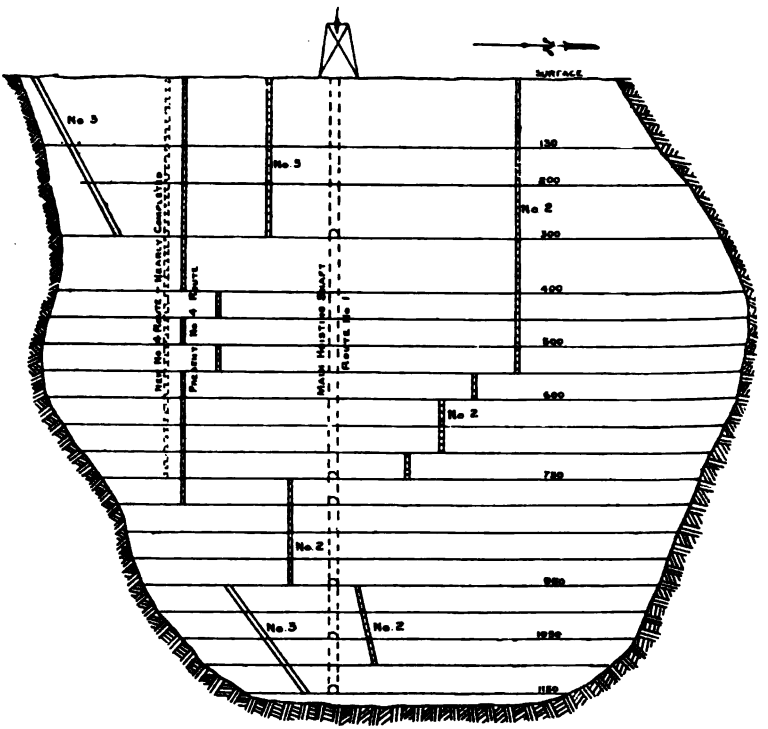
comparatively simple. Unfortunately this condition does not generally exist. The traveling ways connecting a series of levels, drifts, entries, gangways, etc., may be staggered so that upon reaching such a level it may be necessary to travel some distance along that level in order to reach the next ladderway, manway, or the hoisting shaft. Under such conditions the problem of installing simple direction signs is more difficult, but such signs are then more than ever necessary for the new



DIAGRAMMATIC SKETCH OF FRANKLIN MINE
SHOWING RELATIVE LOCATIONS OF TRAVEL ROUTES

FIGURE 3.

employee. The signs must be simple, clear in their meaning, and yet contain as few words as possible.

With the foregoing conditions to contend with (see Figure 3) the author has attempted to overcome them and has installed a system of direction signs which, to date, have proved successful. This system has now been in use for a period of nearly three years.

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KIND OF SIGNS

With a realization that it is sometimes difficult for a person unfamiliar with the mine workings to easily determine which level or entry he is on after having passed several others, it was considered important to indicate the number of the level by a sign (see Figure 4-a) placed wherever a traveling way intersected a level. This practice was carried out at all ladderways, stairways, slopes and shaft stations.

Attention was next devoted to determining the kind of sign to be used to indicate the various types of traveling ways. It was found that there were two types, one of which, however, was of minor importance. The more important of these types was ladderways, including stairways.

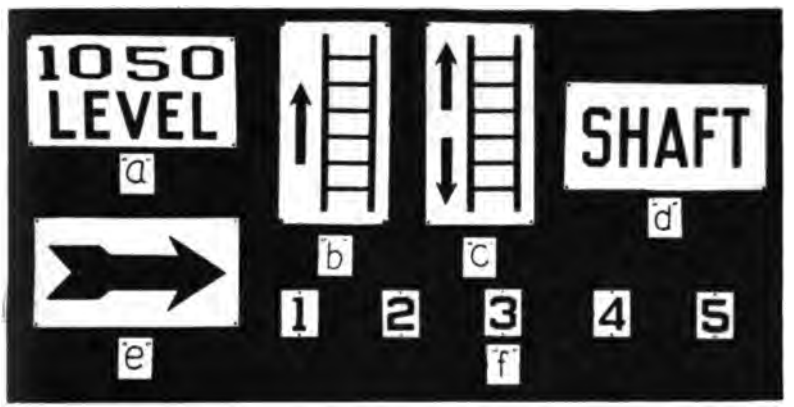

FIGURE 4.

The less important type was in the nature of slopes not directly connected with the general travel routes, yet serving as suitable traveling ways from one part of the mine to another. Although the hoisting shaft is not considered under the head of traveling ways in this paper, yet it was necessary that this, too, should be indicated by some sort of sign. In considering the kinds of signs for indicating these places, it was the endeavor, as far as possible, to eliminate words from the signs.

For the first type—ladderways—the symbol selected to best represent it was that of a ladder, as suggested by Higgins and Steidle in their paper on Mine Signboards. This symbol alone, placed at a ladderway, did not seem to be sufficient as that particular ladderway might not continue past the level but might simply go in one direction to the level above or the level below. With this thought in mind a sign was designed, containing the symbol of a ladder and also to one side a small arrow pointing in a direction parallel to the sides of the ladder (see Figure 4-b). The sign can then be changed as to position to indicate the direction of the ladderway, either upward or downward. To indicate that the ladderway at any point continues past the level the same sign is used, except that two small

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arrows parallel with the sides of the ladder, but pointing in opposite directions are employed (see Figure 4-c).

The next endeavor was to find some symbol which would indicate the hoisting shaft without the use of words. Various symbols such as that used by engineers to indicate shafts on maps, an outline sketch of a cage, a sketch of a headframe, etc., were made and as promptly discarded as unsuitable. After various trials of such symbols and the rejection thereof, the solution to the problem as accepted was the use of the word "Shaft" (see Figure 4-d). The indication by special symbols of the auxiliary traveling ways, where neither stairways nor ladderways were involved, was not considered to be essential.

From the location of the various ladderways as indicated approximately

FIGURE 5.

in Figure 3, it is readily seen that certain routes can easily be established. This was done and the routes were accordingly numbered for the purpose of directing men to any part of the mine especially those who do not understand much English. The numbered routes are shown on the sketch and the numbers used as signs shown in Figure 4-f.

To indicate the direction to a ladderway from any part of a level it was necessary to use one additional sign, that sign bearing a large heavy arrow as shown in Figure 4-e.

From comparative tests made the results obtained indicated that black figures and letters upon a white background gave the best visibility. The signs were all made of enamel baked upon 18 gauge steel. It has been found that such signs have to be handled carefully to avoid chipping, and there still remains some doubt in the author's mind as to the merits of such a sign over one made of thinner gauge metal with the colors lithographed upon.

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Numerous samples of the various signs were made up in paper using different sizes, shapes and thicknesses of letters and figures. These signs were taken into the mine and tests were made to determine which type presented the greatest visibility under the normal mine lighting condi-

FIGURE 6.

tions. The sizes of all the signs, except those of the route numbers, were made uniform at 8"x15".

USES OF SIGNS

On all levels a sign indicating the number of the level was placed at each ladderway, shaft station, or intersection with the traveling ways.

Signs indicating the direction to the shaft were placed at various points

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on the levels which have connections to the hoisting shaft. These points were from 100 to 500 feet apart, depending upon the number of turns that the level made, and also at intersections where the wrong direction might be taken. As the main shaft was designated as route No. 1 the signs were combined as in Figure 5, center.

At each ladderway intersection a combination of signs was used to indicate whether the ladder went upward or downward from that level, or in both directions together with the route number, as in Figure 6.

To indicate the direction to a ladderway from any point on the level the combinations shown in Figure 5 were used. It can be seen that these combinations of signs show not only the direction to a ladderway, but also the direction in which that ladderway goes, as well as the route number. Thus, where a ladderway does not continue beyond any certain level one of these combinations was placed at this point to indicate the direction to the ladderway to the next level.

The miscellaneous routes, indicated by No. 3 on Figure 3, were marked simply with the sign bearing the large arrow and the route number.

FIGURE 7.

The fact that the ladderways were not continuous from the bottom of the mine to the surface made it necessary to use a great many more signs than would have been necessary had the ladderways been continuous. This condition is gradually being overcome and the sign system simplified. The system as originally installed has proved to be very successful.

OTHER MINE SIGNS

Too many danger signs have a tendency to induce indifference to such signs. This statement does not infer an opinion that danger signs should not be used where necessary, but it does mean that danger signs should not be used where an actual hazard does not exist. The only danger signs that the author has found to be a necessity are those shown in Figure 7.

The first of these signs is required by law and, therefore, has been placed on all underground magazines. The sign has white letters on a red background.

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The second sign is the one most generally used through the mine. It consists of the National Safety Council's danger emblem in red and black, and the words "Keep Out" in black on a white background. Each shift boss has a supply of these signs which he uses as occasion requires.

The third sign is similar to the second except that it is smaller, and bears the words "Do not start." Such a sign can be placed on motors, machinery, chutes, switch boxes, etc., thus serving many purposes.

It is not the purpose of this paper to discuss this type of sign, and conditions in other mines may doubtless require additional signs. It is suggested, however, that a more general use be made of the National Safety Council danger emblem to replace signs bearing the word "Danger."

PROVISIONS FOR DRINKING WATER

B. C. Yates, General Manager, Homestake Gold Mining Company, Lead, S. D.

The two principal things to be considered in furnishing a supply of drinking water for the employees of a mine are, first—a plentiful supply of pure water; and, second—the delivery of the supply to such places in and around the mine as are easily accessible to each workman.

Drinking water furnished at the Homestake Mine is procured from springs which issue from the lower beds of limestone which form the capping of a high irregular plateau in the west central part of the Black Hills. The water of these springs probably originates in the snows and rains that fall on this plateau country which is covered with a virgin forest of pine and spruce trees. As this area lies within the boundaries of the Black Hills National Forest, the present favorable conditions will, no doubt, continue.

The analysis of the water as delivered at the mine is as follows:

	Parts per million	Grains per U. S. gallon
Calcium carbonate*	130	7.6
Magnesium carbonate*	76	4.4
Sodium chloride	6	0.35
Sodium sulphate	2	0.12
Silica	13	0.75
Alumina and iron oxide	2.5	0.15
Suspended matter (brown clay)	Traces	

*Calcium and magnesium carbonates are held in solution as bicarbonates with only a trace of free carbonic acid in excess.

This water derives its lime and magnesia from the dolomitic limestone of the Pahasapa formation. Though decidedly "hard" the hardness is only temporary. A few minutes boiling removes the greater part of the solid matter. This would cause the formation of a hard scale in boilers, and for this reason the water is softened for boiler use by adding a small portion of freshly slaked lime, which decomposes the bicarbonates and reduces the total solids from 15 to 4 or 5 grains per gallon.

The water from these springs is conveyed through vitrified tile pipe and iron pipe for short distances, a total of 20 miles to the distributing reservoirs at the mine. The reservoirs are built of mass concrete and

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covered with reinforced concrete. Water for the town of Lead and the mills is also drawn from the same reservoirs.

Bubbling fountains are located at convenient places in the shops, mills, change houses, shaft landings and at the various stations in the mine. No ice is necessary as the temperature of the water as delivered ranges from 40 to 50 degrees Fahrenheit.

The bubbling fountain heads were designed and made in the company shops. The bottom part is of cast iron with a cast aluminum cap screwed on the top. The top is a smooth oval shape with no bowl, the water falling freely over the oval top directly into the waste pipe. Formerly a bowl shaped head was used, but it was found that the bowl became fouled with dirt and remnants of tobacco. In the mine and in the surface plants where three shifts are employed the fountains are left running continuously. In other places they are shut off when not in use.

UNDERGROUND DRINKING FOUNTAIN.

The photograph herewith shows the design of the fountain head and the arrangement of piping and relief-pressure tank as installed on the various levels of the Ellison shaft. A regular faucet is located near the fountain where a bucket of water may be drawn and from which the workmen fill the drink compartment of their lunch pails if desired. Most of the men prefer to go to the fountain for their drink.

Unless the supply is abundant it is necessary to have some means to control the flow as the tendency is to waste water needlessly. This is accomplished by having a regulating cock located in the supply pipe which can be opened only by the use of a wrench. The system of supplying drinking water at the Homestake Mine has been in use for several years and has proved satisfactory. A plentiful supply of pure drinking water tends to make healthy workmen and healthy workmen are efficient workmen.

DISCUSSION

Mr. Goodale asked if it is customary for a shift boss to take a new man over the routes in the mine and explain everything to him before he starts to work.

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Mr. Tillson stated that it was not the custom, as the symbols were readily understood without explanation.

Discussion then developed about the National Safety sign for danger, which was submitted to and demonstrated before the National Safety Council in 1917 by the committee appointed for the purpose of designing such an emblem. The demonstration indicated that the sign submitted by the committee shows up much better than any other sign in twilight conditions.

Richard Maize, State Mine Department of Pennsylvania, stated that the danger sign adopted by the National Safety Council was not recognized as standard by the Department of Mines of Pennsylvania, but that a standard sign had been adopted, and it is the law that these signs be provided and posted in all places where there is real danger. One fault he observed was the indiscriminate use of the danger signs, which cheapened or lessened their value. When the compensation law came into effect, danger signs were considered as something that would help reduce the insurance rates, and danger signs were used regardless of hazardous conditions. This practice of using danger signs promiscuously was immediately condemned, and it was recommended that a warning sign or caution sign should be displayed in all cases except where real danger existed.

Mr. Tillson requested Mr. Maize to use his influence with the Department of Mines of Pennsylvania, to have them investigate carefully the National Safety Council's danger emblem. The failing light found in mines does not show red to advantage; red signs are not valuable except in the case of illumination. Mr. Maize stated that he would bring the matter before the inspectors at their meeting in December.

DRINKING FOUNTAINS

In answer to a question, Mr. Johnson stated that his company has drinking fountains within 100 feet of the shaft and at intersections of main travelways in the mine, at distances of 800 feet to 1,300 feet from the shaft. Water is piped to the 2,000 foot level, and the pressure is broken every 300 feet. The water is tested every spring. The sources are fenced in, so that there shall be no contamination. Miners who work in isolated places, carry water with them.

Mr. Goodale stated that in the Anaconda Mine, the water is piped into the mine and that drinking fountains are being installed. It is necessary to use ice because of the high temperature of the mines.

Mr. Reed stated that his company analyzes the water from springs near the mine at frequent intervals, and if the water is contaminated the spring is put out of commission by rendering it unsightly, so that no person would care to drink from it. Everything is done by the company to induce the miner to make use of the regular water supply of the town.

Mr. Will Castle, of the Clinchfield Coal Corporation, Dante, Va., stated that the miners carry water in their buckets, and that no water is provided for drinking purposes in their mines.

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FIRST-AID STATIONS UNDERGROUND

R. R. Sayers, Chief Surgeon, United States Bureau of Mines, Passed Assistant Surgeon, United States Public Health Service, Washington, D. C.

Underground first-aid dressing stations are especially prepared rooms or chambers, located at points in the mines convenient to the majority of the workers, to be used to receive, examine, dress and give first-aid to the injured. If we consider that the inherent hazards of the industry make it advisable to have underground first-aid dressing stations, there are certain limitations which must be recognized. Where the number of underground employees is very small or the depth or extent of the workings very limited, the value of such stations is materially decreased. The relative value of the two limiting factors is usually conceded to be in the order given, but their value may vary with the individual mine to be considered. The operating regulations for coal mines leased from the government state that "for every separate mine in which more than 25 men are employed underground a refuge and first-aid chamber shall be provided." The number of men employed underground is taken as the chief factor for determining the necessity for first-aid and refuge chambers. In a report of the Prevention of Accidents Committee of South Africa, it is recommended that "in every main traveling shaft at suitable places not less in number than one for every six levels on which ordinary mining operations are conducted, there shall be provided in a suitable locked chamber, in a conspicuous and well-lighted place, the following, as a minimum: two regulation first aid boxes (contents approximate that of the U. S. Bureau of Mines first-aid cabinets) and three stretchers." In regard to flat mines, this committee stated that the underground stations should not be more than three thousand feet apart.

In prescribing first-aid supplies for underground use, most of the states in the east use both factors as a basis. As an example, Pennsylvania requires that, where ten or more men are working two thousand feet or more from the main entrance, first-aid supplies shall be located and maintained in each section of the mine not more than two thousand feet from the working places. Utah has recently adopted a very similar regulation.

GENERAL REQUIREMENTS

An underground first-aid dressing station should be well lighted, well ventilated, dry, equipped to be easily heated and easily cleaned, and of sufficient size not to be crowded when ten or twelve men are in the room. In order to comply with the requirement that it can be easily cleaned, it is advisable to have the walls and roof smoothly plastered with cement. However, in some mines whitewashing the roof and walls at frequent intervals will answer this purpose, but it is usually cheaper and more satisfactory to smooth-plaster in the beginning. The floor should be smooth and dry, concrete being usually most suitable. I have received descriptions of underground first-aid dressing stations from mining men in a

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number of the states, and their better stations all seem to comply with the above.

SIZE

As to size, the government regulation for coal mine leases requires that the first-aid and refuge chamber shall be not less than 6½ feet high, 8 feet wide, and 20 feet long. The better ones now in use in various states have a similar cubic content but may be of different shape, as 10 to 12 feet wide and 14 to 16 feet long with practically the same height. This is true of the mines in Colorado and Utah as well as some of those in Pennsylvania.

LOCATION

The location of underground first-aid dressing stations should be such that they will be easily available to the majority of the workers, but in a well-lighted conspicuous place, in order that in case of need even the newest employee may be able to find them without loss of time. In most mines where there is such a station it is located at the foot of the slope or shaft and in drift mines at a central point on the main haulage way, usually at a parting serving two or more working places. Many of the existing stations are in the office of the foreman, fire boss, or other official, but it is advised that such dressing stations be placed immediately adjacent to such office rather than in it. In order to have good ventilation, the station should be located so that pure live air will be available at all times. This may be done in a coal mine by enlarging a crosscut already driven between the main and back entry and closing each end with a cement stopping, each having a door wide enough to admit an open stretcher easily. It has been brought to my attention that it is sometimes possible to locate the station under a diamond drill hole or core drill hole extending to the surface. This hole will aid in the ventilation of the chamber and may also be used as a conduit for telephone and electric wires, and in case the chamber is used for refuge purposes after disaster, it may be possible to lower food and water to the trapped miners.

MINIMUM EQUIPMENT

The equipment for dressing stations now in use varies greatly. Some have almost no equipment except a first-aid box or cabinet, often with the supplies very much depleted, there being no heat and poor lighting and poor ventilation. Others are obviously over equipped with upholstered reclining chairs, and pictures hanging on the walls in addition to the advisable first-aid material, stretchers, blankets, and cots, and being well lighted by electricity, well heated by the same, and well ventilated. Some of the stations in the west have especially prepared concrete standards to be used for stretcher supports in order that the patient may be examined and his injuries dressed without removing him from the stretcher. The regulations for operating coal mines leased from the government give a minimum equipment requiring 1 first-aid box or cabinet conforming to Bureau of Mines specifications or equipment; 1 Bureau of Mines oxygen resuscitation apparatus or equipment; 1 complete set of splints;

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2 stretchers; 4 pairs clean woolen blankets in oilcloth bags; 1 sealed keg of pure drinking water, renewed weekly; a basin, bucket, and fire extinguisher; 10 yards of clean brattice cloth; 1 keg of nails; the latest map of the mines.

It must be remembered that in these regulations the chamber is also to be used as a refuge in case of disaster. The first-aid material should be kept in tight containers and be so arranged that any type of dressing can be easily found and removed without disturbing the other materials. If the materials are properly protected, placed well up off the floor, and the room is kept dry and heated, they will remain in good condition for an indefinite period.

ACCESSORY EQUIPMENT

In addition to the above equipment at the dressing station, there should be a first-aid cabinet kept adequately equipped at all times, a woolen blanket, a waterproof blanket, a set of splints, and a stretcher located and maintained convenient to the live workings in each section of the mine. The supplies should be protected by placing them in water-proof containers. In many states these supplies are located at the pumping stations, power houses, tool houses, and in some cases on the motor. The men in charge of these houses or of the motor are usually trained in first-aid. These materials should receive protection and be arranged with the same precautions as advised for those at the dressing stations.

All men trained in first-aid should be supplied with sealed sterile first-aid packets in metal cases. These packets should be replaced only when the men report having used the dressing for a definite injury or can give some other legitimate reason for receiving another.

PURPOSE OF FIRST-AID DRESSING STATIONS

In general, underground first-aid dressing stations should be used specifically for that purpose, there being but one other use which seems feasible—that of a refuge chamber in case of disaster such as mine fire or explosion—and I am of the opinion that all first-aid dressing stations should be built with this use in mind, in which case the doors and stoppings should be practically gas proof or arranged so that they can easily be made so with the material kept within the chamber. Further, where compressed air is available in the mine, this should be piped into the chamber in order that it may be turned on in time of disaster to make the chamber positive pressure and to supply fresh air to the occupants.

A first-aid dressing station may be used advantageously for a man severely injured, as he can be made more comfortable and dressing properly adjusted here more easily than in or near working sections. Moreover, much time may elapse between the time of injury and that of taking the patient to the surface. In such a case the injured man will probably be in much better condition on reaching the hospital or physician's care than he would otherwise have been. It is not intended that the dressing station should be used for final treatment of a patient, but only as an intermediate or clearing station before sending the man to a

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physician or to the hospital. But in exceptional cases the first-aid dressing station may become the workroom of the surgeon.

The first-aid station may also be used as a supply station to furnish equipment for first-aid boxes about the mine. It does not seem advisable to use the chamber for a foreman's or other official's office, as it is likely to become a loafing place for the miners, be dirty and poorly kept, and will not be in condition to receive a patient when an accident occurs. All the advantages of having the station in the foreman's office can be obtained by placing it immediately adjacent to such an office.

OBJECTIONS

One of the chief objections put forward to underground first-aid stations is the same as that for supplying first-aid cabinets and other first-aid material underground—that is, the abuse and stealing of these materials. It has been found very difficult to overcome this objection, but by locating the station immediately adjacent to the foreman's office much of the objection is overcome. To obviate or at least minimize the above objection, the practical method is to keep the station and supplies locked, in which case the key should be in a glass-covered case nearby, the glass to be broken when the supplies are needed or when it is necessary to enter the dressing station. Duplicate keys may be distributed to responsible parties who are easily available, provided the foreman and others possessing the key are required to report to the management the use of any material. Frequent inspection, at least once every week, of the materials by the safety engineer, foreman, fire boss, or other man who has been made responsible for the upkeep of the first-aid materials is also an aid. This last duty should be definitely assigned in writing by the mine management to the man.

A second objection to first-aid dressing stations underground is the possible tendency to take an injured man to the station before caring for his injuries in any way. However, I do not think this is serious, provided there are sufficient accessory supplies available and there are an adequate number of competent first-aid men present. If there is a lack of the latter, the entire first-aid work in the mine can only be a partial success.

A third objection is that many of the men having minor injuries dressed at the first-aid station may conclude that it is unnecessary to have the injury treated by a physician. This again depends upon a competent first-aid man being at the station to advise the patient to receive further treatment.

SUMMARY AND RECOMMENDATIONS

1. There should be underground first-aid dressing stations in all mines where 25 or more men are employed underground.

2. All underground first-aid dressing stations should be designed and equipped to be used as a refuge chamber in case of disaster.

3. The underground first-aid dressing stations should be well lighted, well ventilated, heated by electricity or steam, dry, have smooth walls,

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roof and floor, and the walls and roof should be plastered with cement, or, if solid and comparatively smooth, may be whitewashed at regular intervals instead.

4. They should be located at the bottom of the main shaft or slope, or on the main haulage way adjacent to the mine foreman's or other official's underground office. They should be in a conspicuous, well-lighted place and so arranged that fresh air is available at all times.

5. The equipment of the stations should consist of four pair of woolen blankets, complete set of splints, a first-aid cabinet equivalent to that recommended by the U. S. Bureau of Mines, a cot, two chairs, a basin, a bucket, pure drinking water, telephone connection with the surface and distant parts of the mine, electric lights supplemented by safety lamps in case the current is cut off, electric or steam heat, two or more fire extinguishers of a total capacity of ten gallons, a keg of nails, ten yards of clean brattice cloth, and, if practicable, compressed air should be made available within the chamber. Some of the above equipment is chiefly to be used in case of mine disaster.

6. First-aid boxes containing materials specified by the U. S. Bureau of Mines, stretcher, woolen blanket, water-proof blanket and splints, all suitably protected, should be placed in each section of the mine so as to be convenient to the working places of a majority of the men in each section.

7. All competent first-aid men should be supplied with a sealed sterile first-aid packet in a metal case, which should be replaced when the first-aid man reports having used it in dressing an injury.

8. The first-aid dressing station and all first-aid boxes should be locked and the key placed in a container having a glass front which may be broken in case of emergency to obtain the key.

9. The dressing station and all underground first-aid material should be inspected by the safety engineer, or other responsible man designated by the mine management, at regular intervals at least weekly. It should be the duty of such inspector to see that the station and other first-aid material is maintained in good order.

10. An adequate supply of first-aid material properly distributed about the mine, and a sufficient number of competent first-aid men are far more important than underground first-aid dressing stations.

11. The value of a first-aid dressing station is materially increased, if not overshadowed, by its value as a refuge chamber, when prepared to be so used.

DISCUSSION

Mr. Tillson asked if Dr. Sayers recommended first-aid stations underground in a metal mine, or if his recommendation was confined to coal mines. Dr. Sayers stated that a committee in South Africa had studied this question and had recommended that a first-aid dressing station be placed on every sixth level in a metal mine; that would make each level about 300 feet from any one of them.

Mr. Johnson stated that the hospital for his company is located only one-quarter mile from any shaft, and while they have first-aid material

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and stretchers located at convenient places throughout the mine, there are no first-aid stations. Their surgeon prefers to have all cases brought to the hospital.

Mr. Charlton brought up the question as to whether a surgeon was willing to go underground, and told of cases where a surgeon refused to have anything to do with a case until the patient had been brought out of the mine. Dr. Sayers stated that as far as the Bureau of Mines surgeons were concerned, they all go underground, but he finds that all doctors dislike going underground very much.

Mr. Reed stated that there may be doctors who will not go underground, but that his company employs 45 physicians, scattered through four states, and that in not a single case had a doctor refused to go underground. Mr. Reed also told of a first-aid cabinet that is installed throughout the mines of his company, and the method they employ in keeping the cabinets stocked with fresh supplies. One man has charge of each cabinet, and at monthly intervals he checks off on an inventory sheet, the supplies in his cabinet. Additional supplies are sent from the central office to bring the cabinet up to standard. Although men do steal material from the cabinets at times, it amounts to only $10 or $15 a month, and the company is willing to stand that loss.

Dr. Sayers mentioned that it is now a regulation of the United States government that all coal mines leased from the government must have first-aid stations underground if 25 or more men are employed.

Mr. Maize stated that it is very hard to convince the owner or operator of a mine that there is danger of a disaster in his mine. When there is legislation on the matter, it compels the operator to act. Mr. Maize told of a mine where the men who were trained in first-aid carried first-aid packets with them, and whenever they treated an injury, they were paid $1 by the company. This keeps the men an the alert with their packets always full of supplies.

Mr. Seip stated that his company furnishes a first-aid box for each foreman. The first-aid supplies are kept in a metal box; there is also supplied a long wooden box made as nearly water tight as possible, in which is kept a stretcher, blanket, and other supplies. Each shift boss has a crew of five or more trained first-aid men. Whenever the foreman needs additional supplies they are secured from the safety engineer. There are no first-aid stations in his mine.

UNDERGROUND TOILETS AND SEWAGE DISPOSAL FOR MINES

PASSED ASSISTANT SURGEON R. C. WILLIAMS, UNITED STATES PUBLIC HEALTH SERVICE, WASHINGTON, D. C.

The safe disposal of sewage in and around mines is one of the most important problems of mine sanitation. The problem of underground toilets differs for coal mines and metal mines because of the difference in the method of mining operations, the interest and attitude of the mine officials, and the customs of the miners themselves.

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Coal mines have a less urgent need for underground toilets because of the nature of coal mining operations. When the coal in a given area of the mine is exhausted or "worked out" the "room" or working place becomes an abandoned room. A number of "worked out" or abandoned rooms are to be found in any coal mine that has been operating for any length of time.

ABANDONED ROOMS AS TOILETS IN COAL MINES

It is general practice in coal mines to use these abandoned rooms as toilets. There are no seats or containers, the refuse being deposited on the ground. This may be said to be the universal practice in coal mines. From the standpoint of the spread of disease there is no great objection to this method in dry mines, particularly if the miner will take the trouble to cover the excreta with a shovel full of earth. But if the mine is not dry, there is objection to the use of abandoned rooms. Among the objections to the use of abandoned rooms as toilets may be mentioned the pollution of the mine with hookworm infection, pollution of the mine water and drainage, and the filthy condition of such a room if necessary to enter for surveying or inspection purposes. Several mine disasters are on record that were caused by miners unconsciously igniting explosive gas when entering abandoned, uninspected rooms used as toilets.

The lack of any designated toilet in coal mines, except the "worked out" rooms, tends to encourage the men to befoul roadways, entries, or even working places. Such practice is of course very objectionable.

Some coal mines have been known to allow the men to load the excreta into the bottom of coal cars, the cars were hoisted and dumped into the coal washer without any one coming in direct contact with the cars. But when these mine cars required repairing the repair men found the cars very filthy and objectionable, so the practice was discontinued. A few coal mines provide underground toilets consisting of seats and pails or boxes; such instances, however, are rare.

It is believed that the installation and use in coal mines of underground toilets would be a distinct advance in coal mine sanitation. The seat and pail system would berhaps be most practical. The ultimate disposal, cleansing and disinfecting of cans could be done on the surface. Special toilet cars could be used in shaft mines, but they would be impractical for slopes or inclines. A toilet system for coal mines, although increasing the operating cost of a mine because of the expense of installation, upkeep, and scavenger service, would greatly lessen the promiscuous befouling of the mine as well as diminish from a safety standpoint the danger of ignition of explosive gases by men entering abandoned rooms.

TOILET SYSTEMS IN METAL MINES

As previously intimated underground toilet systems in metal mines are usually given some time and thought, even though in many instances the care is hardly worthy of mention. Among the factors that operate to make the use of underground toilets more imperative in metal mines, the following may be mentioned:

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1. The working of metal mines by levels, resembling the stories of a building.
2. The smaller number of available abandoned rooms or stopes.
3. The relatively smaller working areas of metal minies.

Many and varied plans for underground metal mine toilets are in use. The principle of all of them is similar. The excreta is deposited in a receptacle which is later removed to the surface and there disposed of in various ways.

In some mines a horizontal bar for a seat, supported between two upright beams, is used. Underneath the horizontal bar are placed the receptacles, consisting of empty powder boxes, carbide cans, or sometimes galvanized iron pails. A box of sawdust is kept near by to be sprinkled in the receptacle each time the toilet is visited. When almost full the receptacles are carried to the surface, and in the case of the powder boxes and carbide cans are thrown on a waste pile or occasionally burned. The galvanized iron pails are emptied, a disinfecting and deodorant solution added, and then returned underground.

In some instances no seats are provided, the carbide cans or powder boxes are simply placed at a designated location. After use they are taken to the surface and destroyed.

Wooden boxes are not satisfactory as containers because they can never be made water tight. Carbide cans are rather easy to puncture in handling.

Chemical closets are sometimes used underground. They consist of a seat and a tank containing a caustic chemical solution. Agitation is necessary to properly mix the refuse with the chemicals. This agitation is accomplished by means of a mechanical arrangement, and should be done each time the toilet is used.

From time to time the contents of the tank are pumped into a special tank car and carried to the surface for final disposal. The majority of such chemical closets are not satisfactory for mines, because of the great care that is necessary in operating and cleaning.

At a few of the small mines the men are hoisted to the surface in case it is necessary to visit a toilet. Such practice causes much loss of time and is impractical for any but the very smallest mines.

Some mines use a small open sheet-iron car built somewhat like an ore car. This car is placed under a seat and sawdust is sprinkled into it from time to time when used. Later the car is hoisted to the surface and dumped on a waste pile or into a sewer main.

MINE TOILET CARS

In practically all well managed metal mines of production capacity worthy of mention the steel mine toilet car is used. These mine toilet cars are made of $\frac{3}{16}$ inch steel plate. They are about 4 feet long by 2 feet wide by 2½ feet deep, and are usually provided with two seats. The car is cleaned by means of a valve in the bottom. This valve is operated from the top near the seat. Such a car must of necessity be absolutely water tight. There should be as few sharp corners and projections

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inside the car as possible so as to prevent the excreta from adhering to the sides and thus rendering the cleaning difficult. For more detailed specifications as to the construction of such mine toilet cars those interested are referred to Technical Paper No. 132 published by the United States Bureau of Mines, "Underground Latrines for Mines", by Joseph H. White.

Underground flush toilet systems for mines have not proven successful or practical. The chief obstacles and objections are:

1. Cost of installation and maintenance.
2. Cannot be easily moved to different parts of the mine or "new workings."
3. Liability of accidents to plumbing.
4. Extremely filthy and objectionable conditions that may arise in mine in case the system gets out of order.

HAZARDS OF UNSANITARY CONDITIONS

The more common dangers and disagreeable conditions arising from the absence of underground toilets or such toilets that are poorly constructed or improperly operated are:

1. Hookworm disease.
2. Pollution of mine water and mine drainage.
3. Soil pollution.
4. Fouling of mine.
5. Vermin and filth from unclean toilets.
6. The scattering of excreta from leaky receptacles along tracks and roadways, when being hoisted to the surface for emptying.
7. Offensive odors from foul toilets.
8. Ignition of gas by men entering uninspected or abandoned rooms in coal mines, for the purpose of defecating.
9. Improper or unsafe ultimate disposal of excreta whether underground or surface.

In order to avoid the above enumerated disagreeable and dangerous practices there are certain prerequisites for the safe and cleanly disposal of human excreta that apply in general to any and all methods of sewage disposal, whether underground or on the surface. Broadly speaking these general requirements may be mentioned as follows:

1. Elimination of objectionable odors.
2. Privacy.
3. Cleanliness.
4. Accessibility.
5. Adequate ratio of toilets for number of persons employed.
6. Properly constructed toilets consisting of at least a seat and water tight receptacle.
7. Regular and efficient scavenger service.
8. Safe ultimate disposal of excreta.

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SURFACE TOILETS

A measure of great assistance in improving underground sanitary conditions with reference to undergrond toilets is the presence of clean commodious toilets near the entrance of the mine, usually the change house or wash house is the best location. Such toilets should not be close enough to the mine shaft or entrance of slope to be objectionable. Clean, well-kept toilets, convenient to the mine entrance, suggest their use before entering the mine and have a tendency to cause the postponement of the inclination to use the toilet underground until return to the surface. In this way the men are encouraged to use the surface toilets, with the consequent decrease in use of those underground.

The reduction or elimination of disagreeable odors from underground toilets may be accomplished by the use of chemical deodorants, cleanliness in the care of the toilet, and by placing the toilet in a partitioned or curtained off space.

The location of an underground toilet so as to be protected from general view and thus insure comparative privacy is desirable, although not an essential. Cleanliness in operation is certainly essential for any mine toilet. The men are sometimes careless in the use of mine toilets and the seat is befouled. Oftentimes scavenger service is not given at proper intervals and the container may overflow. Constant supervision of the toilets with disciplinary measures for men found befouling the seat, together with efficient scavenger service will improve the cleanliness greatly.

In many mines much time is lost because the men have to traverse a long distance to reach a toilet. This is expensive to the company as idle time. All toilets should be accessible to the greatest number possible. Detached gangs working in less frequented or unused parts of the mine should have a special toilet.

There should always be a sufficient number of toilets on a given level or certain part of a mine to accommodate the number of men in that vicinity. One seat for every 35 men employed is usually considered a fair ratio.

There should be a sufficient number of these cars in the mine so that the men will not have to spend too much time in going to one of them. The nature of the mine will have much to do with determining the number of cars necessary. The wage system and the number and frequency of resting periods also influence the number and locations of the cars. Wherever possible the cars should be stationed in the return airways, although if they are placed in the intake airways no odor should be spread if the cars are kept clean and emptied frequently. An electric light should be placed at these stations and toilet paper should be supplied.

CONSTRUCTION OF TOILETS

The construction of the toilet is very important. Wooden boxes cannot be made water tight and should never be used as containers. Car-

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bide cans and galvanized iron pails should be carefully watched for holes. The steel mine toilet cars should be absolutely water tight.

Regular and efficient scavenger service is essential, otherwise containers may overflow, objectionable odors arise, and the condition of the toilet becomes very repulsive. Poor scavenger service encourages nonuse of toilets and fouling of mine. Toilet cars should be effectively cleaned at frequent intervals. Before a car is lowered into the mine, some dilute deodorizing liquid disinfectant should be poured into it.

If the cars are kept clean and are reasonably convenient, the miners should be compelled to use them. They will be appreciated by most of the men, and drastic punishment should be meted out to the few who are found committing nuisances. In the metal mines of the west where latrines are installed they are said to be universally used. Where the mine workers are unionized there should be an agreement between the operators and the miners to insert a clause in the contract fixing a penalty for the misuse or the nonuse of the underground latrines.

The ultimate disposal of the excreta from underground toilets deserves very careful attention. Disposal into a sewer main or septic tank is satisfactory. If a septic tank is used strong disinfectants or deodorants cannot be used in the toilets as they prevent the proper digesting and liquefying action of the septic tank.

Disposal by burning or burying is satisfactory. If buried it should preferably be done in a shallow furrow or trench and then covered with another furrow. The plot of ground used for this should be fenced and removed from any source of drinking water.

Dumping of untreated excreta on waste piles or into canyons, arroyas, gullies, or ditches, is highly insanitary and should not be tolerated. The final disposal of sewage from mines should always be safe. Dumping into sewer mains or septic tanks is perhaps the safest disposition.

SUMMARY

1. Coal mines should have some definite toilet system. The pail system is acceptable if properly operated and supervised. Toilet cars could be used in shaft mines, but could not be used on slopes or mines having track on an incline.

2. All metal mines of whatever size should use properly constructed steel plate toilet cars or the pail system in sufficient ratio to accommodate the men employed.

3. Underground toilets should be kept clean, and drastic punishment should be given those found committing nuisances.

DISCUSSION

Mr. Seip exhibited a pail-type latrine of all metal construction which is to be tried out by the New Jersey Zinc Company. This latrine is made of galvanized iron with no corners. The seat is one piece of galvanized metal, properly shaped. There are no seams nor crevices on the seat. The seat fits down snugly on the tops of the can, making almost a watertight seal. The cover and handle are always on the can being transport-

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ed. When a clean can is brought into the mine to take the place of the dirty one, the handle and cover is taken from the clean can and placed in the dirty one which is then ready for transportation.

It is planned to provide sawdust or something of that nature to absorb the liquid matter and prevent it slopping over when the can is being handled. By changing these cans once a day, on the night shift, a clean can is always ready for use. The can can be readily washed and sterilized.

Dr. Sayers said that the pail system is being used in the Coeur d'Alene Region and that chloride of lime is used to kill the germs. Although the chloride of lime causes the pail to rust very quickly, it pays to use it because the material is absolutely sterile and the only smell is the chloride. In other places creosote products are used as deodorant instead of chloride of lime. One per cent solution of caustic soda will kill all bacteria; a 3 per cent solution will make the material sterile.

In answer to a question regarding waterproof paper fillers for cans, Mr. Seip stated that paraffin paper linings are manufactured for the purpose which cost about 25 cents each. For a mine the size of the New Jersey Zinc where about 40 cans are in use it would cost $10 a day for paraffin paper linings, in addition to the labor costs involved.

STANDARDIZATION OF FIRST-AID AND FIRST-AID CONTESTS, WITH LISTS OF QUALIFIED PROFESSIONAL AND LAY JUDGES

MAJ. M. J. SHIELDS, AMERICAN RED CROSS FIRST-AID SERVICE, AND CHAIRMAN, COMMITTEE FOR STANDARDIZATION OF FIRST-AID METHODS AND RULES FOR CONDUCTING AND JUDGING FIRST-AID CONTESTS, MINING SECTION, NATIONAL SAFETY COUNCIL

Although I have been continued as chairman of the above committee during the past year, it has not been practical to call the committee together, and what I will now report will be conclusions based on conferences with individual members of the committee such as Dr. R. R. Sayers, Chief Surgeon of the Bureau of Mines, Dr. E. R. Hunter, Director of First-Aid, American Red Cross, and Dr. H. W. Gentles, Chicago Chapter, American Red Cross. As you remember, the following recommendations of the committee were unanimously adopted by the Mining Section at the 1920 Safety Congress in Milwaukee.

1. All classes of employees should be taught first-aid, and men in supervising positions should be especially trained.

2. Minimum number of hours for a course in first-aid should be 15 hours.

3. Physicians who have specialized in first-aid work, and laymen who have received card of appointment as a first-aid instructor by the U. S. Bureau of Mines or the Red Cross, are authorized to teach first-aid courses.

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4. Endorsement is given to the two standard first-aid text books to be issued with identical text by U. S. Bureau of Mines and the Red Cross (Miners' Edition), which are now in the course of revision.

5. In the revision of the Bureau of Mines and Red Cross textbooks standard materials should be advised or named for instructive purposes. Also, the triangular bandage should be emphasized as preferable for first-aid use to the roller bandage. The teaching of the use of the roller bandage should be confined to special cases.

6. Judges at first-aid contests should act as a committee of three, two physicians and one lay judge. The lay judge to be acquainted with the industry represented in the contest. No contest to be held unless a physician be represented among the judges.

7. Contest should be held in accordance with rules formulated and approved by the U. S. Bureau of Mines, the Red Cross, and the National Safety Council. Recognition in drawing up rules for first-aid contests to be given to suggestions submitted as to discounts, team rules, etc., as made by B. F. Tillson, of the New Jersey Zinc Company, and Dr. H. W. Gentles of Chicago, and others.

8. Any first-aid contest to be regular and standard or to be officially recognized shall be first authorized and held under the auspices of either the American Red Cross, U. S. Bureau of Mines, or National Safety Council, and a representative of one of these organizations shall be present at the contest, and no reward of Red Cross or U. S. Bureau of Mines or National Safety Council prizes or awards shall be given unless the above is complied with.

9. The National Safety Council Mining Section shall have a permanent first-aid contest committee composed of a representative from the U. S. Bureau of Mines and the American Red Cross to act in co-operation with the Mining Section and National Safety Council in authorizing and supervising contests and awarding medals and prizes.

But unfortunately we have not been able to carry out Nos. 4 and 5, principally on account of not being able to get such a revised textbook published for financial reasons.

The following rules and discount table have been adopted and it is my understanding that they have worked out splendidly at contests held during the year, notably the International First-Aid and Mine Rescue contests held at St. Louis September 1, 2 and 3, 1921, by the U. S. Bureau of Mines.

RULES GOVERNING FIRST-AID CONTESTS

1. A team will be composed of six men, including a captain. A team of six men includes a captain and a patient. Any employee of a mine, mill, quarry, or smelter may be a member of a contesting team, provided he is not a physician or a trained nurse.
2. At the conclusion of any event, the captain must raise his right hand and anounce his team number. The team will remain at its post until relieved by the judge.
3. Teams must bring their own first-aid materials, including bandages, splints, blankets, etc., and shall not be allowed to leave the patient in order to obtain material.
4. Splints shall not be padded or marked prior to the beginning of any event requiring their use.
5. No practicing will be allowed on the field before the beginning of the contest.

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6. The teams will be numbered consecutively beginning with No. 1, and they must occupy the positions assigned them on the field.

7. **Judging:**

(a) Each team as it performs a problem will be rated by a subcommittee of three judges. Subcommittees of judges will work under a committee of three chief judges, one of whom shall act as chairman.

(b) Subcommittees of judges will perform their work progressively. Each judge will keep and sign his own score card.

(c) Each of the several judging subcommittees shall consist of two doctors skilled in first-aid training and one layman familiar with underground mining methods and trained in first-aid.

(d) Each team will perform the same number of problems, three or more in number. This, of course, does not prevent the running off of ties between the individual teams concerned, but the points made in events performed to decide a tie shall not be included in the total points made in the whole contest.

(e) The same number of teams as there are judges' committees will perform at one time.

(f) All problems will be worked in marked off spaces which shall contain only the judges and contesting teams.

(g) All teams not performing a problem will be placed in location where they are unable to obtain information regarding the problem being worked. No person excepting designated officials will be allowed to communicate with teams waiting to perform problems. Teams which have performed will not be permitted to communicate with teams awaiting their turn.

(h) Problems will be kept in sealed envelopes and given to teams after they enter marked off enclosures, envelopes to be opened only on sound of gong.

(i) Time allowed for reading problem will be stated on the outside of the envelope.

(j) A second gong will be sounded to indicate the time of starting of problem. The captain may decide if he wishes to use more time for reading problem, but such additional time will be included in time allowed for performing problem.

(k) A third gong will be sounded when time for working problem is up. Time consumed in excess of that allowed will be indicated by a gong at one minute intervals, until all teams have completed problem.

(l) Team will be allowed definite period for removing bandages and leaving field—approximately two minutes.

(m) Judges will receive a score card with problem at the top, with discount table and space for discounts below.

(n) Score cards will be signed, turned over to the chief recorder and scores tabulated. Such scores will be kept absolutely confidential by recorders. Announcements of ties will be made by chief judge and ties decided as soon as possible after the completion of the regular problems.

(o) Ties will be decided by one or more problems if time permits; otherwise, by lot.

(p) In any given event time will not be taken into consideration unless the team performing exceeds the allotted time, or fails to give treatment promptly.

(q) Judges will be required to examine the work done in each event and may call on the captain or any member of the team to explain treatment and give symptoms of any injury or condition in the problem.

8. An event embraces a problem that may call for the treatment of one or more injuries and the handling of the patient.

9. Use of banners, lettering, or emblems on garments, or marked first-aid boxes and equipment, or use of means of identification of teams other than by numbers officially assigned, will not be permitted on the field.

10. Teams performing will wear overalls and jumpers or similar form of dress. Jumpers may be removed provided shirt is worn with full length sleeves. Patient will be dressed similarly to other team members.

All bandages will be applied over clothing. Preparation of bandages prior to beginning of problems will not be permitted, with the exception of cravat bandages, which may be folded.

TABLE OF DISCOUNTS

NOTE—No team will be penalized more than once for any one mistake in the same problem where such mistake may be discounted for under more than one of the 14 sections of discounts. However, teams will be

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additionally discounted for repetitions of the same mistake in the same problem, for example: two tight bandages, four points discount, etc.

	POINTS
1. Not doing the most important thing first.	
(a) Failure to temporarily control hemorrhage previous to application of tourniquet	7
(b) Failure to remove patient from dangerous gas, roof, or ground, electric wire, etc., at proper time	4
(c) Failure to do the most important thing first otherwise than specified in (a) and (b)	6
2. Slow and indifferent work.	
(a) Slowness in work—deduct one point for each minute or fraction thereof consumed over the time allotted for working problem	1
(b) Lack of attention or delayed treatment on part of one or more team members	2
(c) Lack of neatness	1
3. Defects in bandaging.	
(a) Failure to entirely cover wound	2
(b) Bandaging or treating wrong location of injury	2
(c) Tight bandage	2
(d) Loose bandage	2
(e) Improperly applied bandage	2
(f) Insecure or granny knot	1
4. Defects in artificial respiration.	
(a) Improper or insufficient preparation of patient for artificial resuscitation	3
(b) Incorrect timing of artificial respiration	2
(c) Ineffective method of artificial respiration	9
5. Splints.	
(a) Splint improperly padded	2
(b) Splint improperly applied	4
6. Unclean first-aid material	3
7. Failure to be aseptic	9
8. Failure to have on hand sufficient and proper material to complete dressings	3
9. Awkward handling of patient	4
10. Assistance lent by patient	2
11. Arterial bleeding	
(a) Application of tourniquet so as not to stop bleeding	10
(b) For non-application of tourniquet charge additional to (a)	2
(c) Tourniquet applied so as to stop bleeding at wrong points, or in such a way as to injure patient	4
12. Not treating shock, or improper treatment of shock	6
13. Failure to command properly (deduct 1 point for each mistake)	1
14. Improper treatment not covered by above, such as wrong dressings, failure to test stretcher, use of previously padded splints and prepared bandages, improper dress of team members, etc	4
	100

I would recommend the above for your approval.

During the year first-aid contests and first-aid have barely held their own, owing in a large measure to the extreme industrial depression, although in one other branch of industry first-aid has progressed, i. e., the telephone industry. The associated Bell Telephone Companies have proved by careful statistics that first-aid is the best vehicle by which to carry safety to their men and they have made it and first-aid contests a permanent policy, and I think it would be a wise policy if all mining companies would look upon first-aid from that angle. First-aid appeals to a natural human instinct and will most certainly carry safe practices with it.

ADJOURNMENT.

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Packers' and Tanners' Section

September 27-30, 1921

A. B. DRUMMOND, Chairman
Wilson and Company, Chicago

HENRY BATCHELDER, Vice-Chairman
A. C. Lawrence Leather Company, Peabody, Mass.

W. F. McCLELLAN, Secretary
Armour and Company, Chicago

TUESDAY MORNING SESSION

THE meeting was called to order by Vice-Chairman Henry Batchelder. The reports of officers and committee chairmen were omitted and the first paper on the program was read by Mr. G. R. Keene in the absence of the author.

ACCIDENT PREVENTION FROM A MEDICAL STANDPOINT

W. H. LIPMAN, M. D., MEDICAL DIRECTOR, SWIFT AND COMPANY, CHICAGO

Medicine of today is largely a science of preventing disease. When the cause of a disease is discovered, more energy is devoted to finding a means of preventing it than is devoted to the attempt to develop a cure for it. Perhaps the best evidence that prevention of disease is looked upon as of greater importance than the cure is the fact that for the past ten or fifteen years the activities of the federal, state and municipal health departments have been very greatly broadened. Their work has become much more comprehensive. Another indication equally as convincing of the value of prevention is the great development of industrial medicine, which has already established for itself a permanent place among the branches of medicine.

Industrial medicine is almost entirely a preventive undertaking. It aims, first of all, to prevent placing the wrong man at a given job, or giving the wrong job to an applicant for employment, all of which is to the benefit of the applicant, the working force and the public. Second,

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it attempts to prevent the spread of illness among employees, either by periodic physical examination or by early treatment of sickness. Third, by promoting efficient care of accidental injuries, it prevents complications and reduces disability to a minimum. In reality this is nothing more or less than safety work; safety for the employee; for his family, for the employer and for the public.

SUCCESS OF SAFETY WORK DEPENDS ON FOREMAN AND DOCTOR

Everyone agrees nowadays that the foreman is looked upon by the workmen as the representative of the company, and whatever he does is interpreted by them as the will or policy of the company. Next to the foreman in the eyes of the men, the plant doctor represents to them the opinion of the company in matters touching accidents and illness. Therefore, success of safety work depends largely on the conduct of the foreman and the doctor, in the way accidents are prevented, and the way they are handled when they do occur. We cannot expect men to believe in safety work if they find their foreman never shows any signs of interest in accidents that occur in his department. On the other hand, if the men see that the foreman watches the safety appliances as diligently as he looks after his machinery or tools; if they see that after an accident occurs, the foreman immediately takes steps to prevent a recurrence or that he reprimands or punishes those guilty of negligence, they will soon enough lend a hand and promote all safety undertakings.

Aside from the opportunity the foreman has for safety work by showing and convincing his men that he is interested in safety just as in any other activity in his department, there is another field by which the foreman can bring home to his men his interest in safety, and that is the interest he displays in the injured man after the accident has occurred. The foreman must see that no matter how slight the injury, the injured man goes to the doctor's office or the first-aid room, as the case may be, at once. It is true, some men with trivial injuries do not see the necessity for treating them and it requires considerable tact on the part of the foreman to explain to them why it is necessary to do so. The object will be defeated and more harm than good will be done, if the foreman orders the man to go to the doctor's office gruffly, without explaining in a simple, dignified, way the necessity for it, because the next time the men have slight injuries they will hide them from the foreman.

After the man has been to the doctor's office and received treatment and returned to work, the foreman will make a serious mistake if he treats the man as though he committed a crime by receiving an injury. If the man is made to feel that by having met with an accident he has injured the safety standing of the department, and therefore put himself in bad, he will not be a very enthusiastic booster for safety. On the other hand if, upon returning to the department, the man is given work that will make him as comfortable as possible consistent with the work of the department, and is treated with a little sympathy and consideration, that man will be won over for safety and will try to avoid accidents

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in the future, and will report every accident he has regardless of how slight it is.

Those of you who have had experience in the care of accidents know we are all human and expect consideration and sympathy and recognition when we are in good health, and that we expect just a little more of these things when we are ill or when we are injured. Imagine how you would feel if, after you had worked for a company for a number of years and become injured and are sent to a hospital or home, you are dropped and your foreman makes no effort to find out how you are getting along; you would soon lose whatever respect you had for the foreman and for the company. On the other hand, if the foreman either calls on the injured employee himself, if consistent with the injured man's length of service and other conditions, or else sends one of his fellow workmen to tell the injured that he wishes to know how he is getting along and inquires when he will be back to work, it will not only help relieve the injured's mind and make the weary days in the hospital shorter, but he will become a booster for the foreman and the company in all their undertakings—including safety work.

So far we have discussed the things that a foreman can do to prevent accidents, but that is not all there is to safety work! Sometimes accidents happen to injuries which are more serious than the original injuries. Accidents may happen to injuries in two ways—first, by not treating the injuries at all and secondly, by mistreating or maltreating them.

ATTEMPTS OF FOREMAN AND WORKMEN TO TREAT INJURIES OFTEN END DISASTROUSLY

We have already seen how important it is that all injuries receive prompt treatment. When a slight injury occurs the foreman is strongly tempted to try and treat it in the department and in many cases this will meet with the favor of the employee. By doing so the foreman and the patient both assume a great responsibility, because while it is true a great many slight injuries get well without any treatment whatsoever, one can never tell which one will cause serious trouble or even terminate fatally. There is no question that neglected slight injuries, cuts, wounds, etc., are the cause of a great share of disability, temporary and permanent. We should issue a strong warning against attempts on the part of foremen or other laymen to try to remove foreign bodies from the eye. A great deal of unnecessary suffering, disability and, according to some reports, even loss of sight has been caused by infection following unsuccessful attempts by those incompetent to do so to remove foreign matter from the eyes. Another practice often followed by serious trouble is for someone in the department, the foreman or a fellow workman, to advise the injured to use his favorite remedy on his injury because it cured someone about fourteen years ago or because a friend of his once knew somebody who had a friend whose injury was healed over night by a certain preparation.

There is no cure-all for injuries any more than for sickness. Healing is delayed, serious complications brought on, and loss of limb at times

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caused by meddlesome treatment at the hands of the unqualified. I recall the case of a young woman who lost the index finger from gangrene caused by soaking the finger in "carbolic water" on the advice of a friend.

Of course, it is impossible to entirely eliminate this danger. People will always give advice to the sick and injured in good faith and with the best of intentions, but the foreman can do a great deal to reduce it to a minimum. He can ask the injured from time to time how he is getting along; whether he is going to the plant doctor's office for treatment or the outside consultant, as the case may be. In that way the foreman will learn whether the injured is getting proper treatment or is using or doing something of doubtful value.

In the beginning of the paper we stated that the plant doctor is looked upon by the men as representing the company in all matters concerning accidental injuries. The importance of this cannot be too strongly emphasized, and it can be seen at once that the manner and spirit with which the doctor treats the patient will not only determine to a great extent the success of the treatment, but they will either make a friend or an enemy of safety out of the injured.

DOCTOR'S PERSONALITY AS WELL AS PROFESSIONAL SKILL IMPORTANT

If the injured is treated inconsiderately, roughly and is jostled around mercilessly, he cannot be expected to entertain a great deal of enthusiasm and confidence in the plant safety work. He reasons that his company cannot be very earnest in its safety campaign if it does not care how the men are treated after they are injured. The doctor must treat injured employees like patients and not like "cases" in whom his only interest is to make an accidental report. An injured man is hypersensitive, or, as a prominent surgeon once put it, he is an insulted man, because his sensibilities have been outraged and he must be handled accordingly.

If the injured is made to feel that the doctor is doing his best to hasten his recovery and promote his comfort, he will gladly submit to the necessary treatment, and will later encourage the other men to go to the doctor's office for treatment with all injuries as well as doing so himself. The doctor must so conduct himself in the treatment of the injured that he will inspire confidence in his professional ability, and the conviction that he is a friend and counselor. He must make them feel that they can come to him with their injuries and receive the best kind of advice; advice that is fair both to him and to the company. Space does not permit going into detail as to what the industrial physician ought and ought not to do in the course of treating industrial accidents, and I am not referring to the purely technical or professional treatment. There are a thousand and one things that go to make up the successful and valuable industrial physician besides his professional skill and learning. The way he handles the injured parts, how he cleans them, what he does to relieve the patient's mind of worry and fear of serious complications, the air with which he notifies the injured's family of what happened to him, the frequency of his calls on the patient at

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home or in the hospital, his absolute adherence to all promises made to the patient, and countless other things are all as important as his knowledge of medicine and surgery.

In closing I would like to reiterate that in my opinion, based on a fairly extensive experience in the practice of industrial medicine, safety work is one of the basic needs of industry. Complete safety work is composed of two parts, one as indispensable as the other, first, mechanical safety devices and, second, a recognition of the importance of the human element before and after the accident, without which mechanical protection can prevent only a small number of accidents.

Discussion was postponed and Mr. Keene was asked to present his own paper.

THE MECHANICAL SIDE OF ACCIDENT PREVENTION IN THE PACKING INDUSTRY

G. R. Keene, Swift and Company, Chicago

To describe in detail the method of guarding all the machines used in the packing industry would consume far more than our limited time would allow. I will, therefore, confine myself to five of the most hazardous machines in the packing industry, which are—(1) the sausage hasher, (2) the steam sausage stuffer, (3) the silent meat cutter, (4) the rocker knife cutter, and (5) the horn saw. These we will take up in the order named.

SAUSAGE HASHER

The danger connected with the operation of the hasher is a hidden one, because the construction of the hopper prevents the operator from seeing the moving worm, or what is commonly called the feed screw.

We have designed two general types of guards, in the form of extensions to the hopper. These guards are so constructed that the operator's hand cannot come in contact with the worm. The cost of installing these guards, including labor and material, is $18 to $23, depending upon the type. The horizontal extension type being the cheaper. Considered from the dollars and cents point of view, and leaving aside any consideration of the humanitarian element involved, the saving accomplished by this guard is most evident.

Accidents on sausage hashers are usually very severe and often result in the loss by amputation, of the hand, and sometimes the arm. Wherever these guards have been installed they have prevented all such accidents on the sausage hasher. Assuming but one severe accident occurs per year in the operation of a sausage hasher, it would entail under the existing compensation laws, the payment for surgical and hospital services, compensation for temporary disability, and for permanent injury, not taking into consideration the loss due to labor turnover, or the decrease in production until a new operator has attained proficiency. This loss would pay for the installation of several dozens of these guards.

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THE STEAM SAUSAGE STUFFER

Accidents occurring on this machine are caused more from carelessness or absent-mindedness than anything else. The accident is caused by the operator placing his hand on the edge or lip of the cylinder while it is being brought to the vertical position under air or steam pressure, and the descending plunger or follower catching the fingers on the edge of the cylinder. All accidents on this machine are serious, usually resulting in the loss of all fingers so caught.

We have designed a guard in the form of an extended lip, which is attached to, and on the same level with the top of the cylinder. This extension prevents the operator from placing his hand on the edge of the cylinder.

THE SILENT CUTTER

Like the hasher, its danger is a hidden one. The revolving knives travelling at a high rate of speed are entirely hidden from the operator. It is true that this machine is sent guarded from the manufacturer, but this guard only covers the top half of the knives leaving the dangerous point of contact exposed. It is at this point of contact that the operator manipulates the product, and where accidents occur.

Injuries received from these knives usually occur on the operator's fingers or hands, while the results in most cases are not serious they are nevertheless painful and result in lost time, but can be entirely eliminated by the installation of the proper guards. This guard consists of nine fingers made from ⅜ in. by ¾ in. flat iron spaced ¾ in. apart, bolted to, and extending downward from the cast iron hood to within ½ in. from the bottom of the revolving bowl. These fingers can be made and installed for $6. Three fingers extend down from the front of the hood and three on each side.

Let us see what an expenditure of $6 means on this machine. First we remove the hazard, thus giving confidence to the operator, and confidence means greater output. Greater output means greater volume per man hour, and greater volume per man hour means less cost to manufacture. Now what do we save? We save the fingers, perhaps the hand, or maybe the arm of the operator, giving him the rights and privileges of enjoying life without becoming a burden to himself or his family. We save the surgical and hospital expense, also the compensation for temporary disability and the compensation for permanent injury, the labor turnover, and the loss in production while breaking in a new operator.

THE ROCKER KNIFE MACHINE

This machine is so constructed that no guard can be devised that will prevent the operator from getting injured where the old method of standing up to the revolving block and turning the product by hand is employed. A great number of accidents occur on this type of machine, some are minor and some are very serious. But accidents of any kind can be eliminated by placing an iron rail around, the rail to be of the same height as the revolving block, and at a distance of no less than

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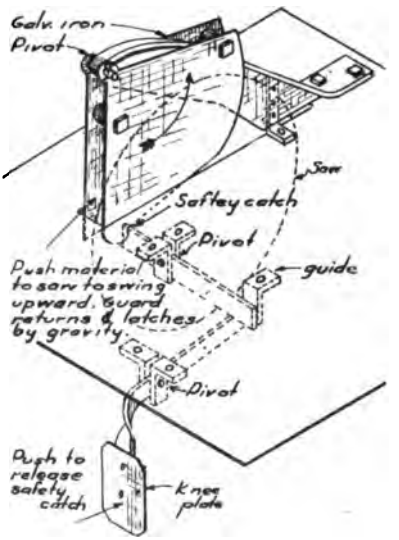
twelve inches from the block. The operator then uses a large flat wooden paddle to turn the product. This is an inexpensive guard and can be made from channel iron, angle iron, or iron pipe, and fastened to the floor.

THE CIRCULAR HORN SAW

For many years the circular saw has been deemed one of the most hazardous of machines. Men have been for years designing safeguards for this type of machine, some were practical, many were impractical. The horn saw is of the same type and construction as that used in all woodworking shops and mills, but the guard that would be practical for a woodworking saw would be useless on the horn saw. There is no need to go into details on the seriousness of the injury in coming into contact with the teeth of a revolving saw. We all know what it means. Prevailing conditions around the horn saw make it even more hazardous than the same type of saw installed in the wood mill. The table top and floor being slimy and slipper is in itself a hazard. Any horn saw that is equipped with a guard that with a light touch will expose the revolving saw is not well guarded, for should the operator slip and any part of him come in contact with such a guard he is sure to be injured. No horn saw is well guarded unless the guard is so constructed that it can be opened only by the operator. I have here a sketch (Fig. 1) of a self locking guard which we have found to be a good practical one, and which cannot be released except at the will of the operator.



In conclusion I wish to say that I have not taken the five machines just mentioned because of the number of accidents occurring on them, but because of the seriousness of the accidents. The guards I have mentioned eliminate the majority of these accidents.

Discussion was again postponed and Mr. Cary presented his paper.

SAFE MOTOR TRUCK OPERATION

C. P. Cary, Packard Motor Car Company of Boston, Boston

The safe operation of motor trucks on streets and highways is dependent upon many factors which have not received the serious consideration they deserve, but the rapid increase of motor vehicles makes it imperative that closer attention be given this matter.

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There were registered in the United States, on December 31, 1920. 900,000 motor trucks, with the greatest density, obviously, in the industrial centers of the east, where many of the cities were founded years before city planning or street layouts were considered, and consequently narrow and crowded streets are numerous.

The greatest number of trucks are used in the hauling and expressing service, which was represented by about 8,500 firms, partnerships and individuals, as shown in an analysis made by the Packard Motor Car Company some months ago. This kind of service takes trucks into the industrial and residential sections of cities, also the county highways.

The value of transportation engineering, or the scientific selection of the proper size of vehicle, based upon study of the character and volume of the work to be performed, and the operating conditions to be encountered, is becoming more noticeable. The Packard Motor Car Company has realized the importance of this service and has maintained transportation engineers for a number of years. It has been uphill work, and while no great advance has been made in the way of generalizing such work, in installing vehicles, yet a sufficient amount has been done to show the advantages and necessity for this kind of engineering, in placing proper and safe vehicles in the streets and on the highways.

EQUIPMENT AND CARE OF TRUCKS IMPORTANT SAFETY FACTORS

Attention should be given to the equipment of motor truck chassis, such as, body best adapted to the work to be performed, the proper size of tires, use of special equipment to replace manual work with mechanical devices, together with safety devices, including horn, head and tail lights, properly regulated and sealed governor, anti-skid chains, fire extinguishers, towing equipment, tools and a first-aid kit.

Special attention should be given to cab ventilation, particularly enclosed cabs, which should be well ventilated to avoid trapping of exhaust gases from the motor, causing drowsiness, or possibly slight attacks of monoxide poisoning. Particular attention is also called to giving the driver a clear vision in such cabs.

Motor trucks should be inspected every day before the truck goes into service. Its physical condition should be known to the driver before it is taken into the street. Special attention should be given to the steering gear, brakes, governor and lubrication. All mechanical parts should be gone over carefully, together with any mechanical equipment, such as hoists and winches. If unusual noises or rattles develop, the nature of them should be ascertained at once, and, if serious or dangerous, the truck taken from the street and the irregularity corrected.

Periodical overhauling of trucks once a year, or every 15,000 to 20,000 miles, as the case may be, should be performed in order that the truck may be safe at all times.

The employment of dependable drivers, and the education of these men in the careful operation of trucks, observance of the traffic laws, precaution against fire and other accidents, should be insisted upon and supplemented by an adequate system of supervision to insure that these regu-

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lations are carefully carried out. The desirability of a system of bonuses for good records of drivers, covering safe operation of trucks for certain periods of time, should be considered by owners and others interested.

The great necessity for good equipment on the streets is becoming more pronounced as greater speeds and loads appear. Trucks which have long since passed their usefulness are operating with steering mechanism and brakes in a dangerous condition. They speed along recklessly, and should an accident threaten, the truck could not be brought under control in the limit of time required. These delapidated trucks, not safe with a normal load, are frequently 100 per cent overloaded.

I would like to compare briefly the motor truck with the freight train. A freight car may be marked 60,000 or 100,000 pounds and is capable of sustaining its capacity load over uneven road beds, pounding over joints, switches and sharp curves, although as a whole no severe strains are encountered. However, the loading is seldom at a maximum because railroad men appreciate the dangers and expense of overloading, having learned this from years of practical experience.

A motor truck runs at varying speeds, with numerous stops and starts, and over rough and crowded streets, with steep grades. The man driving, oftentimes, has been in the cab of a motor truck less than a month, and frequently handles several tons of goods in a working day, besides driving the truck. When the trip is done, which may be after twelve or fifteen hours' service, the truck is driven to a round-house, which may be a public or private garage, or just an ordinary shed, and there it remains until time to start out again in the early morning. This truck cannot be inspected, oiled, or adjusted properly, and may operate in this condition for weeks, when something goes wrong, causing, possibly, the loss of life.

HIGHWAY SIGNS PROMOTE SAFETY

Much good has been accomplished by signs along the highways. More signs will materially assist in the safe operation of vehicles, warning the approach to school houses and churches, or steep grades, particularly where both brakes and motor should be used to insure safety. Signs indicating all low bridges along main highways should be posted at convenient crossroads where detours may be made by loaded trucks requiring more clearance than provided by the bridge.

Eventually all railroad crossings must be eliminated, but until that time, signs should be erected indicating the number of tracks to cross, and possibly to convey the fact that the average train travels one-quarter mile in 20 to 25 seconds. Drivers would then, perhaps, realize the danger of the railroad crossing and exercise more caution.

Warning signs against coasting should be conspicuously displayed, also warnings of soft road shoulders and surfaces which become dangerously slippery from moisture, for many accidents are caused by slippery surfaces or vehicles sinking into soft shoulders of the road. Most of these signs should be visible at night.

Drivers of motor trucks should be required to observe the following rules:

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Be sure your steering gear and brakes are properly adjusted at all times.

Do not let unauthorized people drive your truck.

Do not overspeed.

Have your truck under perfect control at all times, using extreme caution when people are getting on or off street cars in close proximity to you.

Do not pass street cars on the wrong side.

Do not permit loads to extend beyond extreme width of wheels.

Do not carry loads higher than 10½ feet from the ground.

Do not overload.

Do not fail to observe, and immediately correct, any shifting of your load.

Do not coast.

Familiarize yourself with traffic regulations and laws of the highway.

DISCUSSION

MR. J. M. EATON (Libby, McNeill and Libby, Chicago): How long before the average steering gears and brakes need thorough overhauling and replacement of certain parts?

MR. CARY: That depends a great deal on the construction of the gear. The first indication that an inspection is necessary is when the movement on the wheel is about eight inches. The first inspection will probably bring to light the fact that the difficulty is in a looseness of the bushings, in the linkage, and possibly in the square of what we call the drop arm. A tightening of that usually will take up the looseness; it will probably have to be done on heavy trucks every five thousand miles. A thorough overhauling of the steering wheel will be necessary when that no longer takes up.

The brake lining is really the thing that needs overhauling most. It is difficult to say specifically how often. It depends on how they are used. but brakes, when they begin to lack effectiveness, should be adjusted. That is all that is necessary until they again become poor, or are not up to the standard. Then the adjustment should be made on the shoe itself. There is also a method by which the shoe can be adjusted for the wear of the linings. After that adjustment is made, there are no further adjustments that can be made. When the brakes don't function satisfactorily then it is necessary to reline the brakes. In some cases we have brakes relined only once a year; in other cases brakes are relined in about five or six months.

MR. EATON: What I want to get at is what evidence is given the driver should be given him that his brake linings are slipping?

MR. CARY: He knows that from the fact that his truck does not stop in the distance that it did when he first took it out.

MR. EATON: Suppose the truck driver has not been on more than a month or so, and is not qualified to judge—has not operated the truck long enough to know what it did in the first place.

MR. CARY: He will notice many of the vehicles ahead of him take up

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ordinarily about two lengths of the vehicle in stopping. If he has to jam his foot on very hard and possibly use his emergency brake, he knows the brake is not safe. In other words, a brake would not be safe if you could not, at a speed of about eight miles an hour, stop in less than the length of the car.

Some concerns have a daily report which is turned in to the man in authority in the garage at night. The report will indicate if the brakes need adjusting. Then at night time they will adjust these brakes and try the truck over the floor.

MR. P. H. BARTHOLOMEW (Travelers Insurance Company, Hartford, Conn.): I want to ask Mr. Cary about speed governors on trucks.

MR. CARY: Nearly all trucks today have a speed governor which operates above the carbureter on the intake manifold. The principle of practically all these governors is a butterfly valve, which operates to restrict the passage of the moisture through this manifold, and that in turn is regulated by a pair of weights, centrifugal force operating the weights and they in turn operating the valve, and operating off the handshaft or pumpshaft. Then again it is hooked up with the transmission, but in all cases the function is alike on full moisture.

The governor is put on with bolts, and through the bolts small holes are drilled. A seal is then put on by means of wires through these holes. To tamper with it it is necessary to break the seal in most cases, although there used to be a great deal of tampering with the governors, without breaking the seal. We have found some drivers who put nails and wire through the governor and open up the butterfly valve without breaking the seal, but that trouble has been practically eliminated now.

MR. C. G. F. COKER (National Calfskin Company, Peabody, Mass.): You spoke of using the gears to break the jar in connection with the emergency or service brakes. Does that tend to bring excessive wear on the gears?

MR. CARY: No, as a matter of fact, in braking through the gears, you are really using the reverse side of the gear face and your pressure is coming on the face of the gear where usually you don't get it. It is better to do that than to coast or let the truck travel at high speed with just the brakes and throw in the gears at the foot of the hill. When throwing in the gears, it requires considerable practice in judgment, in ascertaining the speed of the gear which is driven by the motor and the gear which is driven by the truck, so they will slip together at about the same speed. I have taken gears out of trucks which had a face of an inch and a quarter and found that three-eighths of the face had been cut away, from constantly grinding gears.

CHAIRMAN BATCHELDER: The next business is the appointment of the nominating committee. I will appoint Mr. Eaton, Mr. Richardson and Mr. Ballentine.

ADJOURNMENT.

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WEDNESDAY MORNING SESSION

MR. EATON: The vice-chairman not being here, I think it is in order that we start the proceedings. The first business on the program this morning is the report of the nominating committee. The nominations which the committee presents are as follows:

For Chairman—A. B. Drummond.

For Vice-Chairman (Tanners')—Dr. Fred O. Elder.

For Vice-Chairman (Packers')—J. M. Eaton.

For Secretary—H. M. Richardson.

For Assistant Secretary—W. F. McClellan.

(A motion was put and unanimously approved electing the candidates named by the nominating committee as officers of the section)

"THE SAFETY MAN AND ATHLETICS"—DISCUSSION

CHAIRMAN EATON: Mr. G. A. Brown, Director of Personnel of the Cleveland Provision Company, Cleveland, who was to deliver a paper on "The Safety Man and Athletics," has been unable to attend. If there is someone else who is familiar with this subject, we would appreciate hearing from him.

MR. E. P. KENNEDY: I would like to ask whether it is better to have a baseball team of amateurs, or a league of high-class professional players and spend considerable money on it?

CHAIRMAN EATON: I would say that when you start hiring professionals, you discourage a lot of aspirants among your employees.

MR. E. E. POPE (Pfister and Vogel Leather Company, Milwaukee): A most successful organization is the Ruby Leather Company, of Fond du Lac, Wis., and they have an entirely amateur team promoted through the safety department.

CHAIRMAN EATON: Libby, McNeill and Libby have a baseball team composed entirely of the employees. We have games between the various departments, which create great rivalry.

MR. F. M. ROSSELAND (National Safety Council): Mr. Brown's suggestion was that the man in charge of safety work could bring himself into close contact with the men in the plant if he took an active part in athletic work. The point is that participation, not as a player, but as a booster, in athletic work and in similar activities that are strictly company business or company work will very much help the man in charge of safety work.

I understand that the executives of large organizations have generally felt that a good semi-professional ball team—or a band, an orchestra, soccer team, or any other similar activity, but one that is cracking good and can compete with most any other professional or semi-professional organization—centralizes the sport ideals and company pride of the workers much better than a team composed purely of amateurs. In smaller towns, however, especially the smaller towns not particularly near cities where professional leagues have teams, you will very often find that the

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strictly amateur team may be equally successful, because it is just as good as any of the other teams in the town.

In Chicago the Commonwealth Edison Company has a very fine orchestra. That orchestra is the pride of about ninety-nine per cent of the employees of that company, and they turn out heavily when the orchestra gives concerts. The orchestra stands high among the best organizations in the musical world in Chicago. Such an organization as that in a small town might be out of place, but an organization made up of employees who are not so well trained, whatever the endeavor may be, would do just as well.

CHAIRMAN EATON: We have in Chicago various leagues, competition among the various industries in baseball and other athletic activities. Mr. Rosseland, don't you think it is better, when you have inter-department games, to leave the professional player off?

MR. ROSSELAND: Unquestionably. However, I do not believe in these activities being forced on employees. They must be the ones to say whether they want them or not. You can encourage an activity, you can suggest it, but don't force it on them. But if you can encourage or develop some evidence of actual interest on the part of the employees the activity will be worth while to the company. I know of one corporation where it is the rule that there shall be no teams unless enough of the employees are interested to warrant the activity, as determined by the committee handling such things. That company has some fifteen thousand employees and they have almost every kind of game you could think of. But not one of those activities is permitted unless the employees show pretty definitely that they want it. The company does not put up all the money to carry on the activity; the employees put up some and they ask for permission.

CHAIRMAN EATON: I think it would benefit us all to have some expression as to whether the safety man should rather encourage rivalry between industries in athletics or rivalry between departments.

MR. ROSSELAND: I believe that the safety man should encourage inter-department activities, inter-department games, whatever the activities may be. His purpose is two-fold: First, to get himself acquainted, liked, trusted by the employees; and, second, to get them to know each other better. In this way there will be a better feeling among the employees. The safety man, in my opinion, will get the most good out of it if he confines himself to inter-department activities, and gets as many employees into the activities as he possibly can.

CHAIRMAN EATON: The next subject on the program is a paper by Mr. Morrison.

BOILERS AND TANKS OR PRESSURE VESSELS

J. P. MORRISON, CHIEF INSPECTOR, HARTFORD STEAM BOILER INSPECTION AND INSURANCE COMPANY, CHICAGO

As the results obtained in many industries depend to a great extent upon the use of steam in power production, as well as in the processes

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peculiar to each particular plant, it is to be expected that the steam boiler and steam engine plants should have received considerable attention from the time steam became a factor in the industries.

During the early days of steam production, when pressures were comparatively low, the strength of the material of which the boiler was constructed, and the design of the boiler, so far as its resistance to pressure stresses was concerned, did not receive as much thought as did the proper arrangement of the heating surface and the improvement of the apparatus consuming the steam the boiler produced. But, as the economies which could be effected by the use of steam of higher pressures and higher temperatures became more generally recognized, pressures began to increase, and defects in material, design and workmanship resulted in failures which in some cases not only were the cause of loss of life and property but resulted in the loss of the use of the boiler, often when it was most needed.

About the middle of the last century, the manufacturers of England formed an association for the purpose of engaging competent persons to examine their boilers periodically, to determine if they were maintained in safe operating condition. This may be said to have been the first step of the safety movement. Quite naturally this service was soon extended to cover the design, and material entering into the construction upon which the safety of the boiler depends.

The results obtained from the inspection of boilers, were soon clearly recognized, and to the inspection was added the insurance feature, by reason of which the owner of a boiler, which exploded after it had been examined and approved as safe to operate, was indemnified for the damage done.

Soon after the advantage of the boiler inspection became generally recognized the legislators of many cities and states, being prompted by the disastrous results of boiler explosions in their communities, adopted rules and regulations, more or less completely outlining the material, design, construction, installation and operation of steam boilers within their jurisdiction. As might be expected, these rules and regulations differed considerably, due to local influences, so a boiler which might be recognized as perfectly safe to operate in one state, could not be used in an adjoining state. This created a chaotic condition in the boiler industry, and soon resulted in the general acknowledgment of the fact that the boiler which is safe to operate in one state, should be safe to operate in any state, and emphasized the need of uniform boiler requirements.

As the result of this condition, the Boiler Code of the American Society of Mechanical Engineers was prepared, and the American Uniform Boiler Law Society formed to encourage its adoption. We are anxiously awaiting the day when a code boiler will be demanded and accepted everywhere, so manufacturers and inspectors may no longer need to maintain their extensive law libraries to guide them as to the requirements of each location. At present the boiler manufacturer must know where his boiler is going. In some cases he must know into what city and into what state, and then the complete drawing, outlining in minute detail everything regarding the material and design and construction of that

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boiler must be checked over, to see whether the law of that city or state is complied with.

No mechanical subject has ever received more careful consideration by able, experienced men than the steam boiler does from the time the iron ore is dug from the ground until the discarded boiler is consigned to the scrap pile.

Not only must the physical properties be within certain limits, but the elements tending to decrease the dependability of the steel, must be reduced to an almost unimaginable amount. For instance, the maximum amount of sulphur permitted is thirty-five one-thousandths of one per cent, and the maximum amount of phosphorus is forty one-thousandths of one per cent; so it may be said that the refinement of boiler plate has nearly reached perfection.

FEW BOILER ACCIDENTS DUE TO FAULTY DESIGN

Boiler design, so far as safety is concerned, follows plans which have become pretty well established, and while boilers of new types frequently appear on the market, they differ little, other than in the arrangement of the various parts, from those we have known for years. The high pressure boiler of modern design, has double, triple or quadruple riveted longitudinal seams of the double butt-strapped type. The heads are either amply stayed, or, if depending upon their shape for strength, are dished to the necessary radius—thickness, diameter and pressure being considered. So we may say, the day of development so far as boiler design and material are concerned, is past, and there are but few accidents to modern boilers which may not be attributed to defective workmanship or improper operating conditions.

The fabrication of a boiler intended for operation where specific rules and regulations must be complied with, must be supervised by an inspector who has been examined to determine his competency, and has secured a commission from the proper authorities. Compare what is ordinarily referred to as the commercial boiler, built without any definite idea as to where it is going, with a boiler coming into Massachusetts, and it does not take an expert to detect the difference, particularly in the workmanship.

Those of you who have had experience with practical mechanics know the degenerating influence of that "good enough" feeling, which may be most easily cultivated where there is immediate, if not permanent profit in doing so, and where disastrous results may be traced back to he original defect only with great difficulty, on account of the elapsed time and contributing causes.

A boiler that lands in Cleveland without inspection may differ widely from the requirements and specifications, and it is quite difficult to detect those variations at that time. Later on, five, ten, or fifteen years—some of the defects which have existed since the boiler was built may have increased and enlarged, until failure takes place. The man who built that boiler, be he ever so honest, will be convinced the accident resulted from the abuse it received during the years of service. While that

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abuse may have had some influence, the initial defect often is found to have existed from the time the boiler left the shop.

Assuming the material, design, and construction are all that they should be, the safe operation of the boiler depends upon its safety appliances as well as upon the care and attention it receives. Certain attachments, ordinarily referred to as safety appliances, are used to indicate the amount of pressure, to guard against an overpressure, to supply the boiler with water, and to indicate the level of the water in the boiler; so the steam gauge, safety valve, feed water connections, and water gauges are considered boiler necessities, and are invariably catalogued as such so that even where there are no covering laws, boilers are provided with them, although they may be of questionable value and may not be suitable for the service intended.

Numerous appliances on the market may be classified as boiler conveniences, and are of advantage when used to supplement, but not to supplant, personal attention. Let me emphasize this statement by saying that the inspection authorities, whether insurance or state, do not object to the use of an auxiliary water gauge, they do not object to the use of an automatic feed water control or high and low water alarm, or anything of that nature, but they do seek to impress upon the owner of the plant, and those who have supervision over the equipment, the fact that those things are conveniences.

It is not essential to the safe operation of the boiler that it have an automatic feed water control, and if the water tender is given to understand an automatic appliance is infallible the day is going to come when it fails to operate. The water tender should feel there is no decrease in his responsibility.

An old adage has been expressed, "If you would judge a citizen, view his back yard," and this has been found true in the power plant. The morale of the employees may be said to vary in direct proportion to the interest taken in the plant by the management. If the boiler room is damp, dark and dirty, increased operating hazard and uneconomical conditions are sure to follow. The boiler room should be habitable to the extent capable attendants may retain their self respect, and be encouraged to look upon only the best condition of boilers, attachments and furnaces, as being "good enough."

PRESSURE VESSELS REQUIRE PERIODICAL INSPECTIONS FOR SAFETY

The necessity of periodical inspection of pressure vessels not subjected to furnace heat is obvious, for one of those vessels, containing a large volume of water under high pressure, and at high temperature, is capable of doing as much damage in case of failure, as would be done by an exploding boiler; and the industrial processes carried on in pressure vessels, particularly those encountered in the packing houses, cause a rapid deterioration in the strength of the material, in addition to an actual reduction in its thickness, so the margin of safety possessed by the new tank, kettle or drier, may soon disappear and failure result, if the condition is not detected in time. A rendering tank may appear perfect, with not the

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slightest indication of the serious deterioration which has affected the inner surfaces, when examined externally.

Experience has taught us that pressure vessels, if of steel, should be constructed of material of a grade at least equal to that required for the parts of a boiler not in the paths of products of combustion, for while an inferior grade of steel may possess slightly greater corrosion resisting properties, a comparatively soft steel is needed to resist the repeated shocks which attend placing such a vessel in service.

This fact seldom receives the consideration it deserves, and many tanks are made of boneyard steel, commonly referred to as tank steel.

The design of the vessel is governed by the service expected of it, so it follows that in a plant of considerable size and varying processes, the size and shape of the pressure vessels will differ accordingly. With those of spherical and cylindrical shapes, the inspector finds little to criticise, but when flat surfaces subjected to deflection stresses, truncated cones subjected to tension stresses, or semi-spherical sheets subjected to collapsing stresses are used, frequently, the margin of safety is insufficient for the pressure carried.

One fruitful source of failure is the support for a stock opening plate, designed to open outwardly, and secured by a cross bar. The bolts and set screws may have sufficient strength to withstand the internal pressure, but to this is added the stresses set up by the ignorant workman at the end of the pipe he has used to extend the wrench leverage, and the threads strip, bolt breaks, or lug fails, with fatal consequences.

The safety of a vessel should not depend upon one bolt, so the use of a properly designed head with bolt openings at its periphery is favored, or if the opening is at the conical bottom of a tank, a gate valve of the proper size is most dependable, and is a time saver of sufficient importance to justify its first cost.

The stock surfaces of all pressure vessels used in the industries are not similarly affected, but the skilled inspector soon locates the points which may be attacked most readily, such points ordinarily being designated as the danger zone, and additional safeguards are provided.

For instance a packing house tank, used to render inedible matter, is most likely to be affected above the stock line, and near the edges of the inner laps of the vertical seams. By drilling ¼ inch holes, ¼ inch deep from the external surface of the sheet the deterioration will be positively detected, when the decrease in thickness has reached the bottom of a tell-tale hole. If a thorough examination reveals only local corrosion, the hole may be plugged with a rivet, and the tank continued in service for a length of time, depending upon its general condition.

After the inspector locates the zone which is most readily affected, he can indicate from the outside, points at which these tell-tale holes should be drilled, ordinarily about a foot apart, a quarter inch in diameter and a quarter inch deep, the depth of the hole somewhat depending on the diameter of the tank, but the range of diameters we ordinarily encounter is from fifty-four to eighty-four inches. As this deterioration continues, it reduces the thickness of the sheet, from the interior, until the point of a drill hole is reached and leakage results.

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If when the tank is examined the deterioration is found to be purely local, the hole may be plugged; but if the examination reveals the fact that this deterioration extends uniformly, or comparatively so for a considerable distance, it is time to order a new tank. By the time the new tank is installed—and it is sometimes two or three months, depending upon conditions—the old tank will be unfit for service. I know of several serious explosions, in which a considerable amount of property was damaged, and men's lives were lost, which would have been avoided had there been any tell-tale holes in the danger zone. It is often possible to improve the safety and lengthen the life of a pressure vessel, by making changes in the design, so as to protect the parts most easily affected by the changes which take place in the course of operation.

A horizontal cylindrical vessel used to dry tankage, is made of two concentrical shells, having a diameter difference of three or four inches. The inner shell is staybolted to the outer as a support against the collapsing stresses produced by the steam in the space between the shells. The stock is agitated by paddles supported by a shaft carried by bearings at each end, the general plan being to have a minimum amount of clearance between the paddles and shell, without having them touch, but the strains in the paddles and shaft, resulting from the shock of starting the agitator when the drier has a charge of wet stock, springs the shaft and permits the paddles to scrape the inner surface of the shell. Bearing boxes not in proper alignment, have the same effect. The scraping of the shell by the paddles, together with the action of the stock, cause the staybolt heads to wear smooth with the inner surface of the sheet which is also rapidly affected. After a drier has been in service but a comparatively short time, one or two years at the most, under ordinary circumstances, it is necessary to change its position, so the friction of the stock and paddles will fall upon surfaces which have not been subjected to wear.

Keeping the shaft straight, and the boxes in proper alignment, do much to prolong the life of the vessel, and with new vessels of that description, the practice of depressing the inner sheet at the staybolt holes, is quite common. This protects the bolt heads from wear, so that if the sheet should be penetrated at some point, the force of the failure would not be sufficient to strip the staybolts. This method of construction was outlined in detail in the *Locomotive* of July, 1916.

A vessel of this description has been in operation for about six years at a plant in East St. Louis. The shafts have been maintained in very good condition, as far as alignment is concerned, but the ordinary work, due to the friction of the stock, would necessitate turning the drier so that the wear would fall on some other surface in a considerably shorter time than that. That drier has not been turned and has shown no considerable wear.

Another plan is to drill tell-tale holes into the inner shell, from the stock side, to a depth equal to the maximum reduction in thickness which can be permitted with safety. The deterioration can be accurately gauged by measuring the remaining depth of the holes, and when a hole has entirely disappeared, the drier should be turned so as to expose other surfaces to the wear.

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Copper is used in the construction of many evaporators and jacketed kettles. Seldom does the manufacturer of such equipment give full consideration to the damage which may be done to the material during the process of drawing or spinning, so the finished vessel may have a margin of safety considerably less than that called for by good practice. When investigating this subject recently, I examined a small copper jacketed kettle, the shell of which had been penetrated by the rolls in the spinning process, by which the cup was formed. Of course, the kettle was worthless but had the wall not been penetrated, although greatly reduced in thickness, the kettle would have been placed in service by the purchaser and, probably, when too late, the defect would have been discovered.

The strength of copper kettles subject to pressure is receiving a great deal of consideration at this time. Investigators have found that, to a great extent, the gauge of material used is a matter of tradition. For instance, one manufacturer, when requested for a set of his standards, thickness, gallon capacity and so on, produced an old book, which had been used by his predecessor for a number of years and handed down to him. Along the margin of the sheet containing the table was a row of figures entered more recently. The manufacturer explained that he had determined the table contained in the book did not give sufficient thickness of material so he had arbitrarily added 10 per cent. So far as he knew, the original table values were arbitrarily established and he arbitrarily added the 10 per cent. There were no particular formulae to go by, and no extended thought was given to the subject, but he just thought that would do.

DISCUSSION

MR. CAMPBELL: Have you any data on built-up plate? I don't mean welded sections, but plate that has deteriorated and been built up by the welding process. Has much data, as to the tensile strength, been obtained on that?

MR. MORRISON: The data that has been compiled is not dependable. The principal reason is that in welding you have to consider the human equation. One man may be a skilled welder and in fine fettle today. He may do a piece of work that cannot be criticised and that by all the tests that can be applied to it, will prove up 100 per cent. Tomorrow morning he may come in a little off nerve, and that nervous condition influences his welding, and the man who seemingly makes a perfect weld today will tomorrow make one that will fail before you get it into service. Then we have the man who is doing all classes of welding work and is not very skilled at any. Once in a while that man will make, by chance, a weld above criticism.

So the same conditions exist with the building-up. We have found built up pitted spots in water tube boiler drums; some hold perfectly satisfactory. In other cases these little "buttons" that had been flowed in, would be found loose in the water leg or in the blowoff pipe.

I understand that the American Welding Society, in conference with a Sub-committee of the Boiler Code Committee, is attempting to draw

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up specifications, by following which you will have a fifty, sixty, or eighty per cent weld—whatever efficiency they determine is dependable. When they get the specifications for a weld completed, the same process will make building-up just as dependable, but until then, where the safety of a vessel depends upon the result of building-up the material, no confidence should be placed in it. If it is just a question of flowing in some metal to prevent further deterioration, that can be done, and is quite frequently succcessful, although a little bit of graphite, mixed with linseed oil and rubbed into the spot smoothly, so as to give it a protecting coating and to prevent impurities from lodging there, will do just as well, if the safety of the vessel has not been jeopardized.

CHAIRMAN EATON: Do tell-tale holes always mean depression?

MR. MORRISON: Let me tell you the origin of the idea: an inspector examined eleven tanks in a packing house. He recommended disconnecting three of them and his recommendation was followed. The steam line was disconnected and they were not again placed in service. Two others of those examined were found to be considerably deteriorated. That was in June, and he recommended that they be removed from service by the first of January. It was his judgment that they would not be safe after the first of January. But when they removed these three tanks from service the balance of the equipment worked over-time. The same stock was coming, so they just worked them a little longer each day, with the result that the two tanks which had been criticised and their time of operation extended to January deteriorated more rapidly than the inspector planned. On the twenty-third of November one of those tanks exploded and wrecked the plant. It cost the insurance company close to twenty thousand dollars for property damaged, decapitated one man and scalded another.

In the danger zone in the tank which failed and in the one which had been criticised as very little better, the sheet had reduced to about one-eighth of an inch, although, when the inspector examined that tank in June, he decided it had a thickness of five-sixteenths of an inch.

If they had had tell-tale holes from the outer surface along the danger zone of the tank when the sheet reduced to one-quarter inch in thickness, the leakage through the tell-tale hole would have given an alarm and the tank would have been removed from service.

Many of the tank builders are putting tell-tale holes in new tanks and when a tank showing marked deterioration is found insist on the tell-tale holes being placed in it. It is a safeguard which is hardly measurable in value.

The safety appliances necessary for vessels in which no pressure is generated, may be placed on the pipe line through which steam is obtained from the boilers. A safety valve set to the correct pressure, a pressure gauge, and a pressure reducing valve, will in that way serve any number of vessels operated in parallel. Of course, a jacketed kettle must be equipped with an open drain, or an automatic drain trap, to carry off the water of condensation, as otherwise a water hammer, with damage to the vessel, is sure to result.

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The digestive apparatus of the plant, as we have termed the pressure vessels, does not need the operating attention demanded by boilers, and it is well that such is the case, for they are looked upon very much as a necessary evil to be cared for principally by those engaged in shoveling fertilizer, or mixing chilli, but if correctly built, of suitable material, properly installed, and frequently, thoroughly inspected, no great danger attends their operation.

The idea that the policeman on the block must make frequent arrests in order to demonstrate his ability and authority has disappeared. The officer who can maintain order with no arrests is prefered. So it is with the inspector who visits your premises, he desires to submit a favorable report, but his knowledge of accidents, failures and difficulties elsewhere, places him on guard, so attention may be called to imperfections which have caused no local uneasiness, although at some other plant, under less favorable conditions, a similar defect may have resulted in loss of life, to say nothing of damage to property. Conditions change. Expansion, contraction and manipulation stresses increase the strains in the material. The material is weakened by fatigue and deterioration. So the fact that it has never failed is not conclusive that it never will, otherwise we would be here at the millennial dawn. So before deciding that an inspector's recommendations are based upon a desire to criticise, investigate the range of possibility, and retire the boiler, tank, or pressure vessel from service, pending final judgment in case its immediate safety is questioned.

CHAIRMAN EATON: Our next subject is to be presented by Mr. Ballentine.

MECHANICAL SAFEGUARDS

J. E. BALLENTINE, MASTER MECHANIC, A. C. LAWRENCE LEATHER COMPANY, PEABODY, MASS.

In the old days it was the popular belief that accidents were acts of Providence, and that they could not be prevented, that they were something arising out of the contingencies of life that were uncontrollable, overlooking the fact that men were endowed with the necessary faculties for their guidance and protection, but our experience of the past decade since the safety movement has attained momentum shows that accidents can be prevented in the major part.

Mechanical safeguards ever since this idea was first conceived have made steady progress in development, and I am convinced as a result of my experience that we have long since passed the experimental stage and are now approaching the point of scientific development.

The man who designs and builds guards should always have before him a real object, the service to humanity, the saving of life and limb which you know will very likely be lost if you do not put your heart in your job. If you would make your plant a safe place in which to work you must guard ever moving part, where practical, on which a workman would be likely to be injured.

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DESIGNING AND CONSTRUCTION OF GUARDS

It is of the utmost importance in designing and constructing guards to consult the foremen and workmen who are to use them. The guard should not only protect the operator on the machine but should also protect the passer-by, and of course construction should not be of such a nature that it will interfere with production. The guarded machine or part must at all times be easily accessible for oiling, inspection, repairs, cleaning, etc. Doors or movable sections should be hinged to overcome these obstacles, and above all things the guards should not be flimsy. I believe it will be found that substantial metal guards are much cheaper in the long run.

STANDARDIZATION OF GUARDS

While a great deal has been accomplished along the lines of standardization of guards, it is quite common to have standardized guards installed in plants that are a source of great discontent among the foremen and workmen, and such types hinder the safety movement more than they help. The standard guard is not always practical, it ties up production, it is not always adjustable to the machine, and while the materials used in the guarding may be standardized, the designing of the guard in most instances must be made to meet the individual or group conditions.

FOREMEN

A big factor in connection with safeguarding is the foreman. Your master mechanics and safety engineers and safety committees may comb your plants from morning till night looking for hazards, but if the foreman is not sold on the value of safeguarding, your efforts are in vain. Remember it is the foreman who is responsible for the operation of the machinery and the production. He is frequently the man who approves the removal of a guard and in many instances he is responsible for leaving it off. Therefore it is wise to get his co-operation and ideas on designing and placing of safe devices. I would even go further and say that it is often good policy to consult the workman when designing safeguards, as frequently he has ideas of his own on the hazard, and by eliminating the danger as he sees it you will get a more satisfied employee in your ranks.

On the other hand it is sometimes difficult to change a man's habits, but by showing the workman the danger involved in his method and the protection the installation of a guard will give him, I believe the guard will be tolerated in a more gracious manner.

In mechanical safeguarding we are confronted with the problem of even making our machinery fool-proof. I dislike very much to use this term, for I have confidence that the average man has sense enough to safeguard his own life and limbs, but it seems that occasionally we find in our ranks the man who is determined to "beat" your safety devices.

Our first mechanical guard was brought about as the result of a serious accident we had on one of our pin wheels about sixteen years ago. In those days safety appliances were looked upon as a hindrance to produc-

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tion and something to be frowned upon in general. In spite of this sentiment our company diligently pursed the policy of safety, later organizing safety committees, inspection committees, etc., and sparing no expense in properly guarding against every hazard, and making our plants safe places to work in. I wish to explain the working of two mechanical safeguards of our own invention used on elevators and pin wheels.

SHIPPER LOCK AND BRAKE ON PIN WHEEL

An automatic spring clamp holds the shipper. This has proved a very effective device in locking the shipper, but we have not stopped here. We have also taken into consideration the possibility of a loose pulley "grabbing" the shaft and starting the wheel. To overcome this we have installed an automatic brake, which holds the wheel fast while the belt is on the loose puley.

ELEVATOR HINGE PLATFORMS IN FLOOR SECTIONS

The floors of the buiding are hinged so that as a protruding object strikes the floor, the floor section which is hinged arises and allows the car to pass without injury to the protruding object. As the car passes the floor, the floor section drops back in place.

A section of the floor of the elevator car is hinged. This likewise would protect any object protruding into the elevator shaft from any floor of the building as the elevator descends. On striking the object protruding from any floor, the hinged section on the elevator car rises and allows the car to pass without injuring the object.

These devices have been installed for a period of about four years, and we have not had a single accident on any of our elevators. Previous to this installation we had a number of accidents where employees stood too close to the edge of the car getting their feet caught by the descending elevator—two of these accidents proved fatal.

MR. POPE: Your safety gates were not sufficient on your elevators to keep your people out, were they?

MR. BALLENTINE: No. A man standing on the car going up would persist in standing close to the edge.

MR. POPE: Those toe guards are set up when the elevator is in motion, are they? They give way when anything comes between?

MR. BALLENTINE: Yes.

CHAIRMAN EATON: Would they be strong enough to sustain a heavy truck load? We often have trucks on our elevators carrying five to eight hundred pounds.

MR. BALLENTINE: We carry as much as two thousand pounds.

ADJOURNMENT.

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FRIDAY MORNING SESSION

CHAIRMAN EATON: The first item on our program is a talk by Mr. W. B. Kinghorn.

ACTUAL ACCIDENT EXPERIENCE AND ITS RELATION TO INSURANCE RATES

W. B. KINGHORN, SUPERVISING INSPECTOR, THE TRAVELERS INDEMNITY COMPANY, HARTFORD, CONN.

We don't have very much to do, in fact, the inspectors in the field under my supervision have nothing to do with what we call experience rating, but experience rating is very closely related to the application of the schedule, and the two combined go to make up the rating of a risk.

Although there are several methods used in tanning, and each tanner has his own hobbies in connection with the work, the operations involve practically the same hazards. The conditions that we find around the pits, both for soaking and unhairing, are wet conditions, which of course are characteristic of the business. Floors that are unsafe or kept in unsafe condition are necessarily charged for in accordance with the hazards which they present. They are characteristic of the tanning industry, and while it is a difficult proposition to tax the tanning industry with a charge on floors, nevertheless the importance of protection as well as possible remains, in order to keep the workmen from slipping and falling at the vats, and becoming burned with lime solutions, chromium solutions, and so forth.

There is a lot of heavy and cumbersome machinery used in the tanning industry, such as skiving-machines and splitting-machines and fleshing-machines, and these are all taken care of under various items of the schedule. Machinery principally under the working machine hazard and power transmission is taken care of under the power transmission part of the schedule. That has to do with horizontal shafting and transmission belts, gears and pulleys, etc. Shafting is measured by the number of linear feet that are exposed, and charged for accordingly. Together with power transmission there is power control, exposed gears and dry belts, included in the transmission, that is, transmission dry belts. The schedule is necessarily one of the fundamentals in the rating of the risk, and that is one of the reasons why I dwelt upon the necessity for guarding machinery. Even though guarding doesn't eliminate all of the accidents that occur in a plant, it does tend to make the workmen be careful, and it has to do with reduction of this experience, which has such a bearing on the rate.

When the schedule is properly applied, the inspector, as you all know, goes through the plant and notes every condition. If the owners or the management of the various industries only realized fully, not only from a safety standpoint but from a dollars and cents standpoint, the

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importance of the inspector's visit, they would be inclined to be a great deal more cordial to him. I think it is up to every manager or owner of a plant to issue instructions in his plant that when an inspector comes there, he is not to be permitted to leave the plant without first having seen some one in authority to explain the result of his visit, so that he will get the benefit beforehand of any conditions that the inspector might have noted. In some plants, in fact, I might say in most plants today the inspector is given a great deal of opportunity to talk on safety organization work, but in some instances he is not given much of a chance to talk on this subject—principally in the small plants. Now it is just as important for a small plant to have a safety organization that conforms with the standard, as it is for a large plant, because proportionately the same reduction in rate can be given for safety organization in any plant that is subject to schedule rating.

When the plant shall have been insured long enough, the insurance company applies what is known as the experience rating plan, in conjunction with the schedule rating plan. The experience rating plan consists of two parts; that is, the actual amount paid out for compensation and the actual amount paid out in dollars and cents for medical aid. Therefore, it will be seen that if small accidents occur frequently in plants and medical aid is paid, and if accidents occur with any degree of frequency the bill for medical aid amounts in some cases to far more than the bill for actual compensation made. This actual accident experience cost is compared with the pure premium paid out on the individual risk and a credit or charge is allowed, as the case may be. If an employer succeeds in having a clean record, so far as accidents are concerned, his return is great enough from that standpoint alone to make him become vitally interested in keeping down the accidents of any type in his plant.

When it comes right down to brass tacks, the experience on a risk has as much to do with the rating of it as the schedule has, and there is just as much credit that can be obtained by keeping accidents down in a plant as there can be in remedying conditions about the plant along physical lines.

DISCUSSION

CHAIRMAN EATON: I think any one interested in Safety, in the prevention of accidents, especially under the present conditions of industrial depression which influence all of us in our accident expenses, should be particularly interested in this subject, the reduction of premiums and the reduction of rates through accident prevention. If you can show your firm that through your efforts you can reduce your experience cost and thereby obtain a reduction in your premiums, they will be much better satisfied with your work.

I speak of my own experience for the simple reason that as a result of the co-operation of our superintendent, foremen, and other employees, we have been offered rates showing a reduction of from 20 to 25 cents in

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rates, on each $100 of payroll. When you figure on a $5,000,000 payroll, that amounts to something in savings.

I have noticed the same thing in our western plants, that when we organized safety committees, had monthly meetings, and a weekly inspection report was made by the plant inspector, which was gone over very thoroughly by the safety committee in its monthly meeting, as well as the inspection report from the insurance inspector, we began to get results.

The rates out in California were pretty high when I took hold; there hadn't been any safety work done to amount to anything, and at the present time, in view of the establishment of the Rating Bureau, which of course controls the rates in the various states, we have been able to obtain the minimum rate which our industry is allowed under that bureau's rulings, and in addition to that all the various safety credits.

MR. POPE: Has there been any reduction in the hazard in tanneries during the past two or three years?

MR. KINGHORN: Yes, several companies in Massachusetts have very good rates as the result of their safety organization work.

MR. MORTON (Massachusetts Rating Bureau, Boston): The rate on tanning in Massachusetts has been reduced from $1.55 to $1.35 per $100 of payroll.

CHAIRMAN EATON: In figuring your rates on various industries here in the State of Massachusetts, do you separate the plants or the industries which show an inclination to cut down accidents by spending money in safety organization.

MR. MORTON: No sir; we follow the schedule in that respect, and those individual plants get the additional credit through the schedule and through the rating plan. In making up the rating for the entire industry, we include all the plants in the state, because the countrywide experience is used also.

CHAIRMAN EATON: I asked this question for the simple reason that in Ontario, an insurance company is not allowed in there, because that is called a monopolistic state. Various industries of the section with which we are connected do not follow out the safety idea as closely as we are following it, and we are held up to this assessment on account of their deficiency. I was wondering if you had any complaints from parties situated in a similar position?

MR. MORTON: Not to my knowledge.

CHAIRMAN EATON: If you did have what steps would you take?

MR. JOHN J. MADDEN, JR. (Aetna Life Insrance Company, Boston): I wonder if I might be allowed to answer your question, perhaps as a matter of rate for classifications made up as the result of the pure premium of that classification, which means just this: that all the payroll is added together, divided by all the losses under that classification, which gives the pure premium for the United States. In addition to that, the experience of each individual state is treated in a like manner, and through the loading of overhead, catastrophe, and other items which you will agree are necessary, is obtained what is commonly known as a state factor, which is applied to the national manual rate. The method of

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arriving at the manual rate is universal. If, for example, in an industry we have 100 factories in one state, fifty of whom are energetic in the matter of safety organization and fifty of whom are not so energetic, then the fifty factories which are energetic are penalized for the fifty factories which are not energetic; in other words, your state pure premium takes in all of these factories.

As has been said by Mr. Morton, there has been a reduction in rate, which is to a great extent due to the fact that many employers who have a large number of employees are rapidly awakening to the fact that if they don't have safety organization and insist upon safety appliances, they are penalizing the rest of the industry.

MR. POPE: The reason I asked the question is that my experience in getting rates from insurance companies, both on compensation and group and non-occupational accident and health insurance, has shown me that the tanning industry to a very large extent, particularly in the west, is very much misunderstood. It may be of benefit to you insurance men here today when I tell you that, according to a member of the Industrial Commission of Wisconsin, the compensation accident record in our plant, employing 3,000 people, runs about one-third of what it does in the metal trades. Another rather interesting experience was that three years ago we put in group insurance on health and non-occupational accidents. We had some trouble in placing this policy. One concern finally took it with a great deal of reluctance, and their experience for that year instead of being a sad experience was a rather happy one and we had the premium reduced and the benefit increased; and their experience for the second year was such that that better rate was continued for the third year.

I can't understand, from my own experience, why the tanning industry is put down as a hazardous occupation, unless it has been studied from the standpoint of fifty years ago, or something of that kind.

CHAIRMAN EATON: The reason why I asked about the possibility of getting credits was because in the last year we had an accident experience cost test record of about 115 days, and we were assessed $1,000, and that seemed unreasonable to me. The only suggestion I could get out of the industrial commission of the Province of Ontario was to join the Accident Prevention Association, and through our own efforts with the other industries encourage them to plan safety organization and accident prevention work; instead of taking that question up themselves with the individual industries responsible for these high ratings, they put it up to us.

MR. MADDEN: The safety organization, your accident loss cost test, and your first-aid are the three important items under the schedule which affect your adjusted rate. They are the items which affect more directly the experience rating plan, such as slippery floors and bad stairs, missing hand-rails, bad ventilation, bad lighting, etc. All those things will be taken care of if there is an efficient safety organization in the plant; and I don't think that can be denied.

CHAIRMAN EATON: We have with us Dr. Fred O. Elder of Wakefield, Massachusetts, who will present the next subject.

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OCCUPATIONAL HAZARDS INCIDENT TO THE TANNING INDUSTRY

Dr. Fred O. Elder, M. D., Medical Director, National Leather Company, Wakefield, Mass.

In these days of government regulations covering sanitary handling of hides, sheepskins, calfskins and tannery wastes, anthrax ought not to be the menace that it is. At our plants we have been inclined to regard anthrax infection rather lightly because of the fact that in the past eight years of our connection with the largest tanneries of New England, where hides, calfskins, sheepskins and pigskins are handled, we have had no anthrax whatever.

Yet, when we know that in Massachusetts for the year 1920 there were 17 cases reported, with 4 deaths, and that 11 were traced to hides, 1 to wool, and 1 to hair, we can only believe that a better federal control of anthrax infected hides is urgently needed.

Anthrax is not confined to the leather industry. I recall the case of a coal dealer, who had not the remotest connection with a tannery, who was infected on the neck. This was thought to be due to handling infected money.

Early diagnosis is most important. The carbuncle of anthrax, often confused with the ordinary carbuncle, is distinguished from the latter by the central depression, the absence of pain, tenderness, and suppuration of the first as contrasted with the elevated center, the multiple foci of infection and sloughing, and the severe pain of the second. The most successful treatment, as advised by the Massachusetts State Board of Health, has been rest in bed, liquid diet, bichloride poultices, together with anthrax serum. Incision of the wound is not advised, as this is liable to produce anthracemia, due to libration of the confined spores to the blood stream, a condition from which few recover. There must be a break in the skin to allow entrance of the anthrax spore. Therefore, early disinfection of any wound, however small, is a great prophylactic.

DERMATOSES

These inflammations of the skin are usually of the eczematous type, varying from a reddened itching condition to a severe scaly form of dermatitis which resists treatment. They are caused by the handling of lime solutions and the various mixtures and chemicals used in finishing processes. The parts affected are usually the hands, arms and forearms.

In general, dermatoses are confined to the man new to the job, the well seasoned worker having little or no trouble. Occasionally when we run across a worker who is particularly susceptible to a certain agent we have found it a waste of time and money to return him, when cured, to the same work. Placing him on work of a different character avoids a recurrence.

BURNS

Handlers of limed hides or skins develop a condition of the skin, which at times takes on the appearance of a second degree burn, and at other

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times has all the characteristics of an ordinary boil. A torn or dirty rubber glove or boot, or failure to wear protective clothing, is always the cause. If gloves and boots are kept tight and clean inside, this trouble never develops.

The friction burn on the buffing wheel is in our experience most common. They have all the appearance of a second or third degree burn from heat. These are caused by end of skin catching and drawing arm against rapidly revolving sand paper covered wheel. We have had one recently of so deep a character that skin grafting was required.

The blacking machine is another cause of friction burn, the skin catching and drawing arm between brush and roller.

Much less frequent is the burn from contact with the hot embossing machine plate. These burns are due to the carelessness of the operator in reaching between the moving plates to straighten the skin, the hand or arm being caught sufficiently to burn it, the machine being stopped in time to save loss of hands or arms. Sticks with which the operator and feeder straighten the skins are provided, making it unnecessary to place the fingers between the plates. At our plant one such burn has resulted in total disability to date of over two years.

Scalds from steam used for heating water, or from leaky valves, are frequent, as are burns from contact with exposed steam pipes.

Acid burns are more frequent than they should be. At our plant the acid is poured from carboy to pitcher, and as it spatters it is likely to hit the worker and often does. Pumps have been tried, but so far are too slow to be of practical value.

WOUNDS

The tenter hook is the most common cause of puncture wounds, and occasionally causes lacerated wounds also. These hooks are always ancient, always filthy, and so such wounds are infected from the start. It has been our practice to cauterize such wounds with pure carbolic acid, followed by alcohol as a neutralizer. This has worked out well.

The tacking nail, another filthy thing which covers the floor of the tacking room, produces a mean, deep puncture wound, usually on the sole of the foot. The average tacker works at high speed on a piece basis, lets the tacks fall where they will and with the floor covered, easily punctures the thin soles of the old shoes which he wears.

The shaving machine is a prolific source of severe incised wounds. The principal cause is, we believe, the fact that these machines are operated upon a piece work basis, which means work at top speed and an easy chance of injury.

The whitening machine is sometimes a cause of multiple incised wounds. Here again, piece work and speed is a factor. Carelessness in the use of the trimming knife causes many incised wounds.

The rolling jack and glazing jack give us many contused and lacerated wounds, with now and then a compound fractured finger, due principally to inattention on the part of the worker. The quick, experienced hand has little trouble, the victim, as a rule, being the green worker.

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CHROME SORES

Chrome sores are also called chrome ulcers and chrome bites. They are literally deep holes in the flesh, caused by chronic acid burns. They are very obstinate in healing and always cause much lost time.

Some years ago, with the chrome tannage then used, these ulcers were frequent with us, but for the last few years with a tannage of a different character we have entirely eliminated this trouble.

JAPANNING

Wood alcohol, inhalation of which carries a long train of serious disturbances, is no longer used by us. In its place we use a thinner which is not a hazard in any sense.

Naphtha is used to clean leather and dilute the so-called varnish.

Amyl-acetate, which is a solvent for pyroxlin, gives us no trouble on account of the adequate ventilation system which we have.

The heat of the varnish room is disagreeable, but so far as we know, has caused no disability.

With men accustomed to the work and proper ventilation, we think we have removed the hazards of this end of our industry.

EYE INJURIES

These are occasionally caused by foreign bodies as in other industries, by flying tacks in the tacking room where hides are ripped off the boards. We have one such injury on our records today, which to date has resulted in three years total disability from blindness.

Sulphuric and hydrochloric acid spattered from carboys has resulted in serious eye injury. These carboys have a clay stopper which is usually loose and permits a leakage of acid when the carboy is handled. An extra cover made of heavy paper or tin is placed over the stopper and prevents splashing from doing harm. Careless pouring from carboy to pitcher has caused many eye injuries. A satisfactory pump for quick handling of acid ought to be developed.

AMPUTATIONS

The putting out machine once in a while gives us a nasty amputation, usually at the wrist. Here, piece work speed and taking a chance in reaching between the rollers to straighten a skin is the cause. The experienced man, who knows how to throw the skin in flat, has no trouble.

The embossing machine used to give us amputations of one, and less often, both hands at the wrist. Such an injury is always due to the carelessness of the operator in reaching between the moving jaws. We use two types of machines: the Turner, a one-man type, which has no guards, but is provided with a two ring control so placed above the operator's head that it requires both hands to pull them, and in this way the hands are kept safely out of the way when the jaws come together. The other, or Sheridan machine, is a two-man affair, having a feeder

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and an operator. The feeder's side is provided with an immovable shelf, 31 inches deep, over which it is practically impossible for the ordinary man to reach. On the operator's side is a shelf about 16 inches deep, which is movable and comes up as the jaws of the machine are moving together. The operator can easily reach over this shelf, but its value lies in the warning it gives as it moves toward him. The shelves are valuable also because they give the men a place to safely rest their hand. Previous to their use, it was the custom to rest the hand on the edge of plate, often resulting in a nipped finger.

STRAIN

Low back, sacro-illiac and ankle strain are fairly common, particularly from slipping on wet floors in the beamhouse.

RHEUMATISM

This is said by some authorities to be a hazard of the industry. I do not agree that this is so, for those exposed to the wet conditions of some parts of the tannery are, by far, the most husky of our workers. I believe it is true, however, that the worker, who is already rheumatic, will upon taking up this work find his condition made worse on account of the exposure to wet and excessive humidity and frequent changes of temperature.

ODORS

Contrary to the general belief held by the public, I believe the odors associated with tanneries are far from being harmful.

DISCUSSION

MR. BARTHOLOMEW: I would like to ask Dr. Elder to what he attributes the high percentage of fatalities in connection with anthrax? Is it due to the fact that diagnosis is not made promptly?

DR. ELDER: I don't think the percentage is particularly high. We had seventeen cases in Massachusetts in 1920, four of which died. That percentage isn't especially high; but I think, as you say, it is generally due to failure to make an early diagnosis. It takes a pretty good man to diagnose anthrax right off the reel, and it is really diagnosis that counts.

MR. KINGHORN: I would like to ask the doctor if there weren't far more anthrax cases in 1919 than there were in 1920, showing that more attention is being given to that particular phase of the industry than before. If I am not mistaken, either in 1917 of 1918 there were more cases than in 1920.

DR. ELDER: That may be true; I haven't the figures, but I do agree with you that they are doing more today, which probably has something to do with the lessening of the figure.

MR. KINGHORN: That, of course, indicates that if those matters are given attention, those cases can be eradicated and wiped out.

DR. ELDER: There is no question about it.

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MR. POPE: Is it not a fact, doctor, that there is a great deal of "hurrah" made about cases of anthrax that are really not anthrax at all?

DR. ELDER: The state board of health here will tell you that a great many cases are reported as anthrax that don't really turn out to be anthrax. I haven't seen a case in eight years. If I had a fellow die on me tomorrow with anthrax, I would probably see a dozen of them next year; every case of carbuncle I had, I would think was anthrax.

CHAIRMAN EATON: We have a report from the chairman of the membership committee, Mr. Pope, which shows that two new members were accepted, both in the packing industry and seven withdrew in the packing industry. Their reasons for withdrawal were as follows:

One left because they were affiliated with a number of other plants which were already members of the Council; one was in the hands of a receiver, and the balance gave reasons as simply as a matter of economy.

MR. COKER: I would like to ask Mr. Pope his opinion as to whether the withdrawals from membership in the National Safety Council are really an economy?

MR. POPE: I don't think there is anybody who has really taken advantage of the bulletin service, of the general ideas advanced by the National Safety Council, who will say it is economy to withdraw. If they considered it an economy, it was through a mistaken idea, or through carelessness, or want of interest in taking advantage of the ideas and service offered by the National Safety Council. I might say in connection with that, that as far as we packers and tanners are concerned, we ourselves are to blame for the scarcity of material that is handled for us by the National Safety Council. They can't make up bulletins themselves. We in the industry are the ones to offer the material to pass on from one to another, making it a co-operative proposition entirely. I don't believe that, in the four years that we have been members, there have been a half dozen tanners' bulletins issued by the Council, and that is our fault; it isn't the fault of the National Safety Council.

CHAIRMAN EATON: The next paper is by Mr. Pope.

HEALTH AND SANITATION IN THE TANNERY

P. E. POPE, MANAGER, LABOR DEPARTMENT, PFISTER AND VOGEL LEATHER COMPANY, MILWAUKEE, WIS.

In view of the fact that the industrial commissions of many states are recognizing the hazards of industrial disease on a much wider scale than heretofore, my subject is a timely one. I have no hesitancy in making the prediction that before long rules and regulations for the promotion of health in industry will be just as sweeping as those pertaining to accident prevention are today! Therefore, I hope to see the tanning industry with its "lamps all trimmed and burning", a leader in the great work of sending the man home safe and well.

One of the difficulties confronting us in this work is the class of labor

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that we have to deal with. Difficulties are encountered in obtaining anything but the most common labor for certain departments of the plant, and these difficulties call for the greatest patience and perseverance in putting over any work of this kind. In every industry there are and will be certain operations or departments more hazardous than others. I shall touch on only a few of these in the tanning industry, and among them I would mention the hide house. The handling of dry hides brings the worker in contact with dust containing more or less deleterious matter which will eventually develop throat or lung trouble. Unless the engineering department has installed a satisfactory system of exhaust fans for the purpose of removing this dust, the men should be instructed to wear respirators.

I shall not touch on the subject of anthrax except to direct your attention to the necessity of being properly armed to handle it should you be unfortunate enough to have a case. Convince yourself beyond doubt that your physician has made a special study of this disease and is able to recognize a case at once—or more to the point, is able to make a proper diagnosis of the real trouble and not call it anthrax when it is not. Tanneries have received a great deal of unpleasant notoriety through the prevalence of the idea that anthrax is a common disease in the industry. The fact of the matter is that in thirty years of experience, with 3,000 men on the payroll, we have had only one case of real anthrax. Many other tanneries throughout the country will testify to similar conditions. It is absolutely necessary that your physician be well enough acquainted with this disease to be able to properly diagnose it and treat it in the first stages. Many instructive articles are in print on this subject, and your library ought to have copies of a few of them such as, "Anthrax as an Occupational Disease" from the U. S. Labor Department, "What Tanneries Should Know About Anthrax" by R. S. Bonsib, and a number of other papers on the subject by well-known physicians, printed by the National Association of Tanners.

SHOWER BATHS PROTECT WORKERS' HEALTH

We would naturally expect a certain degree of catarrhal and rheumatic ailments from the employees of the beam house, owing to the moist air and damp surroundings, and yet it is a matter of record that we have less loss of time through sickness from this department than any other one in the plant. Our method of overcoming the results of this unfavorable condition is by proper ventilation in the workshop and clean, dry dressing rooms and lunch rooms, coupled up with special efforts to educate the worker to the necessity of complete change of clothing when the day's work is done. To assist this work, all employees in the wet or damp departments should be provided with double lockers, one section for his street clothes and the other section for his work clothes, and this latter section should be provided with a hot blast so that work clothes will be thoroughly dried when he dons them in the morning for his day's work. We ought to go a step further and furnish shower baths in connection with the dressing rooms. By the time a man has taken a bath

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and changed his clothes his chances of becoming chilled on his return to the street have been minimized. Will they use the shower baths? Well, here is our experience. Some years ago, on an inspection trip, I found the floor of one of the dressing rooms around the wash basin very wet, and on asking the foreman (who was not very fond of colored help) for an explanation, his answer was that every time he turned his back, those damn niggers would try to take a bath in the wash-bowl. I suggested that we furnish them with shower and his answer was a snort of disgust. However, we equipped the dressing room with showers and a few weeks later I asked the foreman if the showers were being used, and he said yes they were being used, and those niggers were even teaching the white people to use them. But to my mind the joke of the whole thing came about six months later when the foreman wanted to know why he could not have a shower bath in his dressing room. With the installation of these showers and our insistence that the workers use them and change their clothes before going to the street, there was less time lost through sickness, and much less of the odor of the tannery on the employees' clothing.

The buffing and brushing departments are also places worthy of careful consideration. The wheel and Bruzzell machine create a fine dust that not only requires a heavy suction of air at the machines, but also some thorough system of taking the dust from the air of the room, otherwise the workmen's lungs will soon be in a splendid condition to become affected.

Your tacking rooms and the tackers are also worthy of study. I found on investigation that not enough care has been taken in cooling these rooms in the morning before the workmen went into them. Temperatures from 90 to 105 were found and men sometimes stripped to the waist working in this atmosphere with the cool air from the open windows, giving a splendid opportunity to plant tubercular germs through the contraction of a bad cold. Another source of danger with the tackers was the holding of tacks in the mouth. These tacks are dirty, probably have been used many times, have been on the floor, sorting table, etc., and then put in the mouth, and constitute a means of conveying germs to the pasture lot.

PAPER CUSPIDORS PROVE MOST SANITARY AND CONVENIENT

Another place where no money should be spared is in the coating room of the patent leather department. The combination of materials used in this coating room formed a serious hazard from an explosive standpoint, and the workmen are exposed to a number of industrial poisons which would bring disability which could sometimes be properly classed under the term "Occupational disease".

It is unnecessary to call your attention to the necessity of providing cuspidors throughout the entire plant, and also of the enforcement of the use of them. Until a few years ago, we used a galvanized pan about 16 inches in diameter and 5 inches deep, with about 2 inches of liquid disinfectant in each of these pans, which were emptied frequently. The

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objection to this was that when anything solid was thrown in it, or when the employees expectorated into it, the liquid splashed the surrounding wall or floor. It was successful as a sanitary measure, but it was exceedingly disagreeable in appearance as well as considerable bother and trouble, as it was frequently upset or pushed around in such a way as to spill the contents. We have now adopted the paper cuspidor filled with spent-bark and placed on a square or a corner painted white. These cuspidors are gathered up daily and sent to the furnace room. We have found them more sanitary, create a better appearance, easier taken care of, and therefore are more economical in every way.

I take it that no factory has overlooked the importance of the drinking water supply, therefore will not dwell on that subject!

Clean, well ventilated dressing rooms, equipped with wash bowls, shower baths, benches, tables, and individual lockers for the men in each department, are a paying investment. We found that one large dressing room for the entire tannery was not a success; the men objected seriously to a three or a five minute walk to the wash room, and our experience has shown us that the wash and dressing room placed in close proximity to the department in which the man works is greatly appreciated and used by every man of that department. Stimulate competition among these departments in the keeping of the dressing rooms neat and clean and you will find that the interest taken by the management in furnishing these accommodations will be returned many times over by the improvement in the class of man-power in the plant.

When all reasonable preventative measures have been taken inside the plant, then it is time to follow the man to his home, and in this work much delicacy and diplomacy must be exercised—the foundation and opportunity of this work will be found in the plant first-aid hospital. In fact, I have found the hospital nurse an excellent aid in obtaining the confidence of the worker who has hitherto stood aloof. The opportunity for the doctor and nurse to weld the men and management together is very great, therefore the personality of the doctor, as well as the nurses must be considered second only to their ability. I wish to emphasize strongly the value and need of having a competent physician. It is a matter for each individual company to decide as to the necessity of having a full time doctor. Our experience has been that two hours a day is sufficient to take care of our entire organization, and I take pride in being able to state that in eight years with 3,000 employees, we have not lost as much as a part of a finger from infection. In fact we have not made an amputation of any kind caused by infection. I do not believe that this record would have been possible had we had an inexperienced doctor. Experience is by no means the only qualification to fit a man for the job of industrial physician. He should have a broad vision of the fundamentals of industrial relations. If he is the right man he will be the most valuable assistant to the relations department.

CHECKING UP ABSENTEES

In preventing loss of time from sickness, our visiting nurse is an important factor. Our absent record sheet is checked up each morning

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and the messenger calls on all absentees at their homes, that is absentees who have not been excused by the foreman. He ascertains the reason of their absence. If the reason is "not feeling well" or "sick," the messenger at once calls the company's visiting nurse who advises with the employee as to what course to pursue to get back on the job in the shortest length of time. This also gives the company access to the home where much good can be accomplished in the way of needed sanitary measures. My experience prompts me to say that unsanitary surroundings in the home, insufficient nourishment in the food provided, bad teeth and tonsils, and colds, are responsible for sickness, of which industrial conditions should be credited with only an atom of responsibility. With the present tendency of industrial commissions to consider industrial diseases, it behooves the employer to spare no effort to build up his organization to further the work of prevention of sickness both out of the plant as well as in the plant.

DISCUSSION

MR. KINGHORN: Mention was made by both Mr. Pope and Dr. Elder of the tacking room and numerous tacks in the feet. I have often recommended, and I wonder whether it is practicable or not, corrugated floors in the tacking room, that is, corrugated floors of good design and of the proper depth to permit the tacks to be in grooves instead of lying on the flat floor, where they will penetrate the foot if stepped on. Would that have a tendency to injure the employee by causing flat feet, or anything like that, if the corrugated floors were properly designed and constructed?

MR. POPE: We don't have any trouble with punctured feet. We insist on having our men wear a heavy soled shoe in the tacking room. We find that guards us from any trouble in that way. He can wear as light an upper as he wants, but he has to have a fairly heavy sole. The tackers soles are made by our own man. The half sole of the shoe is furnished free of charge to the employee.

MR. H. M. RICHARDSON (A. C. Lawrence Leather Company, Boston): About how many absent employees do you have to look up a day?

MR POPE: When we are running full force it will average probably thirty. We are now running with about two thousand and of course they are sticking to their jobs better and we only look up about eight or nine. A man is not out of our plant forty-eight hours but what we know where he is and why he is out.

Some years ago we had a man lose his arm through infection. We only needed one lesson. We want to know where our men are and why they are out.

CHAIRMAN EATON: As a rule does the visiting nurse render subsequent dressing to employees who are absent on account of slight injuries?

MR. POPE: That is up to her. She takes care of an accident after it leaves the plant—she and the doctor together. If it is necessary for the doctor to go to the house, he goes, but if not, the injured man comes to the plant hospital. Even if he is off work, he comes to the plant hospital, if he is able to. If not, the nurse takes care of him at his own home.

The messenger service and visiting nurse prevents us from being im-

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posed on by malingerers; they can't get away with it when you are following them up that closely.

DR. ELDER: I would like to ask Mr. Pope if he ever finds that the employee or his family resent the visit of the nurse.

MR. POPE: Ninety-five per cent of them are glad to see her. She is a rather diplomatic woman, has been doing this work for a long time, and is pretty thoroughly acquainted with most of our staff. We have made it a point to "sell" our medical service and our hospital service to our employees—not in any way to force it on them. I posted a bulletin inviting our employees to take advantage of our first-aid rooms if they have a cold or a pain, or a headache, or want advice of any kind; that our medical service is free, and that we not only invite but we request them to come to the first-aid room for advice and assistance.

As far as plant accidents are concerned our foremen are held absolutely responsible for a man failing to report even a scratch on his finger. If a man comes into the first-aid hospital and says that he got this scratch on his finger three days ago, we don't ask him if he reported it to his foreman but we go to the foreman, or at least we send a report to the foreman that that man's accident happened on the third and he didn't report to the hospital until the fifth, and we ask him what is the matter.

DR. ELDER: How is the foreman going to know? Here is John Smith who gets a little scratch on his finger, but he doesn't say a word to the foreman. How is the foreman going to know it?

MR. POPE: We want the foreman to know whether his men are right or not, even if he has to make the rounds and look them over. It is a paying proposition.

MR. COKER: I would like to ask Mr. Pope, in connection with this health and sanitation, if he has considered the food warmer in the factory, or cafeteria?

MR. POPE: Oh, yes, we have a very fine cafeteria in our plant, serving a lunch at 9:20 in the morning. We take a ten minute recess from 9:20 to 9.30. At that time we serve coffee and sandwiches. Then at noon of course we have the regular cafeteria, where all the men can get as much of a meal as they want.

MR. KINGHORN: Mr. Pope, are the men required to wash before they take their food? I understand there would be some danger of infection if they were to go in, as they usually do, with dirty hands right from their work.

MR. POPE: No, we haven't yet insisted on that.

DR. ELDER: Mr. Pope, with three thousand employees, how many nurses do you require? You have a part-time physician who spends two hours a day, and the work is done by the nurses in his absence.

MR. POPE: We have a nurse in each of our plants, that is, three plants. They are in different parts of the city, and there is a nurse at each plant. Then the doctor comes down to the central plant every morning and they telephone in to him from the other two plants. We have our plants divided, roughly, into a thousand employees each, so there is about one nurse to each thousand. Then there is one visiting nurse in addition.

MR. COKER: I might say in regard to Mr. Pope's reference to shower

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baths, that they were put into our plant as an accident prevention measure. We found that at closing hours many of the men, more particularly the ones that we regard as the unintelligent, the foreign-speaking help, would use the steam and water hose in between the pin-wheels in the tan-house or dye-house for taking a bath after their day's work was done, and we frequently had serious burning accidents from steam, on that account. The shower baths were put in the dressing room, and the men were compelled to use them.

MISS MARY C. WIGGIN (Consumers League): Mr. Pope, I wonder whether you have a service worker or whether any of your nurses walk through the plant.

MR. POPE: In connection with that I will say that I spend all of the time that I possibly can in the plant, myself. It is rather limited, but we seem to be getting along pretty well. I have no special people for that. The nurses are kept in their hospitals. We are not spending a dollar on what is commonly called "welfare". We confine our activities entirely to a dollars and cents proposition, and, unless we can see a monetary return for what we are doing, we are going to lop it off right away. By putting in this non-occupational accident and health group insurance, the men get $14 a week benefit for $12 a year. In that way our employees are covered twenty-four hours a day for compensation, nine hours in the plant by the state compensation, and the balance of the day with this group policy. The employees pay fifty cents a month on that and the company pays the other fifty cents. We have never introduced anything in connection with labor that has met with the appreciation, and is as good a paying proposition, as that non-occupational accident and health insurance.

CHAIRMAN EATON: You say they are paid $14 a week; if they are injured in the plant they get the compensation, or if they are sick they get it. Suppose you have a case of occupational disease which is sufficiently complicated so that the doctor is in doubt as to his diagnosis; it might be a constitutional disease or it might be an occupational disease—how do you treat that?

MR. POPE: I usually turn it over to the insurance company, if I can.

MR. COKER: Mr. Pope, how do you gauge your visiting nurse proposition as a dollars and cents proposition?

MR. POPE: Only in a general way—and these figures will be satisfactory to some of you as to whether it is a dollars and cents proposition or not. During 1919, which, probably you will all agree with me, was the worst labor year this country has ever known and the year when labor was at the peak of unrest, our turnover during that year was 116 per cent. and for this year so far (of course, they are all sticking to their jobs this year) from the looks of it now, it will be about 44 per cent in the tannery. I believe that answers your question as to the financial part of it.

MR. COKER: In the turnover in general; but would you apply that all to the results of the visiting nurse?

MR. POPE: That is only a part of it. You can't set down the services of your nurse under any one thing; it has to be put into a general proposition.

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MR. CHARLES F. GLUECK (John Hancock Mutual Life Insurance Company, Boston): How many weeks would the benefit continue?

MR. POPE: Twenty-six weeks.

DR. ELDER: We have a benefit association. The premiums paid by the employee are from fifteen cents to one dollar a week, and the benefits covering accidents, sickness on the plant or off, and death benefit, vary from $200 to $1,600, depending on the premium paid; and in addition to that we give a man who is out sick and who has worked for us two years steadily, one quarter of his average pay for a period of fifteen weeks. In the event of total disability, we have often continued them for a period of five years. In addition to that in this state the compensation doesn't begin until the eleventh day and we pay the compensation for industrial accidents for the first ten days.

MR. GLUECK: What was the cause of those disability accidents that you had?

DR. ELDER: In one case in which we paid for a period of five years, the man had a tumor of the brain, resulting in his blindness. We carried him along until his children were able to support him. It was not a condition due to the trade at all.

MR. POPE: This matter of M. B. A.'s and other agencies for taking care of employees has been discussed a good deal at this Congress and at others. I want to show you the difference between the average M. B. A. and our method of assisting our employees. Every man who comes into our plant becomes insured, and I will bet you that there aren't more than seventy-five per cent of the employees of the average concern that has an M. B. A. who will become members, and invariably the twenty-five per cent who are out, who are not members, are the ones who need it the worst. Isn't that right?

DR. ELDER: That is right. Of course we have found it difficult to sell this insurance to the employees.

CHAIRMAN EATON: Do we understand that yours is compulsory to the employees?

MR. POPE: Yes; when he comes in and takes his employment, he is given a little booklet explaining this insurance and he is given a couple of days to decide whether he wants it or not. There are two blanks in the little book that he signs, one a refusal or an acceptance, and he signs either one of the two. If the book comes back with a refusal, he is called into the employment office and the matter is explained to him fully again. Usually, after that, there isn't any question about it. Sometimes he refused because of a misunderstanding. When we first put this over it was entirely a voluntary proposition and 98 per cent of the plant took it at that. However, it is now recognized as a compulsory proposition.

ADJOURNMENT.

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Paper and Pulp Section

September 27 and 28, 1921

G. E. WILLIAMSON, Chairman
Executive Engineer, Strathmore Paper Company, Mittineague, Mass.

F. P. YOUNG, Vice-Chairman
Interlake Pulp and Paper Company, Appleton, Wis.

MISS MARY BAKER, Secretary
Kimberly-Clark Company, Neenah, Wis.

TUESDAY MORNING SESSION

CHAIRMAN WILLIAMSON opened the meeting with a brief review of the activities of the Paper and Pulp Section during the year. He explained that he had consented to serve as chairman at the request of the section in place of Mr. S. F. Shattuck, of the Kimberly-Clark Company, Neenah, Wis., who was elected to this office by the section at the last Annual Congress, but who had found it impossible to serve. Mr. Williamson reported that he had been successful in securing men prominent in the paper and pulp industry to serve as members of committees, and although there had of necessity been some delay in organizing these committees, they had functioned well during the short time they had been active. He recommended that, so far as possible, the personnel of these committees be retained so that the section could have the benefit of their services during the ensuing year.

Mr. Williamson commended the American Paper and Pulp Association for the active interest which this organization is taking in the work of the section and for its valuable services in obtaining new members. As an example of this very cordial and helpful co-operation, Mr. O. M. Porter, Assistant Secretary of the American Paper and Pulp Association, is now serving as chairman of the membership committee of the Paper and Pulp Section. The remainder of the committee is made up entirely of mill executives, presidents, treasurers, general superintendents, and others who in their respective communities have a very high standing, and whose influence in building up the membership of the section will have the best possible results.

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Mr. Walter A. Gleason, of the Hammermill Paper Company, Erie, Pa., presented a brief report as chairman of the program committee. A communication from the chairman of the bulletin committee Mr. Ameil Umberhaum, Green Bay Bag and Paper Company, Green Bay, Wis., was read. Mr. Umberhaum reported that 26 special bulletins had been issued to members of the section, in accordance with the plan to distribute such bulletins bi-weekly. The preparation of these bulletins, however, had been a somewhat difficult task for the committee, owing to the fact that so few of the members responded to its appeals for suggestions and material in the form of photographs and drawings suitable for illustrating the bulletins and making them attractive. Acknowledgment was made to the following members from whom such material had been received: Hammermill Paper Company, Dill and Collins, Riordon Pulp and Paper Company, Spanish River Pulp and Paper Company, Champion Fibre Company, Marathon Paper Mills Company, Kimberly-Clark Company, Consolidated Water Power and Paper Company, and the International Paper Company. The members were urged to assist the bulletin committees by sending the chairman copies of all "home-made" bulletins which they prepare, as well as copies of photographs and drawings which might be suitable for bulletin use.

Mr. Williamson supplemented this report by saying that the bulletin service is one of the most important services which the National Safety Council renders, and he also urged the members to assist the chairman of the bulletin committee by furnishing suggestions and illustrations, so that the sectional bulletin service may be maintained on a high plane of efficiency. The report of the membership committee was then presented by Mr. Porter.

Mr. Porter: The membership committee started its work rather late in the year. In accordance with suggestions from your chairman, a letter explaining the work of the section and the work of the National Safety Council, and urging membership in the Paper and Pulp Section, was sent in August to all members of the American Paper and Pulp Association, largely because the membership of the American Paper and Pulp Association probably constitute sixty per cent of the pulp and paper manufacturers of the United States. A second letter was sent to these same mills in the middle of September.

It is now planned to send to the individual members of the membership committee lists of the mills in their vicinity from whom no reply has been received to these membership appeal letters, the idea being that after correspondence has done what it can to secure membership, then we shall have to rely upon a personal appeal by the individual members of the committee.

Further membership plans involve correspondence with both members and non-members of the American Paper and Pulp Association; in other words, the membership committee of the Paper and Pulp Section plans a nation-wide membership campaign. It is probable that results from this campaign will be almost negligible during the present period of readjustment, but it is hoped that the seed thus planted may bring large returns in a more prosperous period.

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Your committee reports the following new members: American Writing Paper Company, Holyoke, Mass.; Dennison Manufacturing Company, Framingham, Mass.; Watervliet Paper Company, Watervliet, Michigan; Fort Howard Paper Company, Green Bay, Wisconsin.

CHAIRMAN WILLIAMSON: The first paper on our program was written by Mr. Roy J. Murbach of the Gardner and Harvey Company, Middletown, Ohio. Mr. Murbach was unable to come, and his paper will be read by Mr. Walter Gleason of the Hammermill Paper Company.

MANAGER'S AND FOREMEN'S RESPONSIBILITIES

ROY J. MURBACH, THE GARDNER AND HARVEY COMPANY, MIDDLETOWN, OHIO

The day of personal contact is a thing of the past in the majority of plants. Formerly, when plants were small the manager was personally acquainted with every man in his establishment, and they understood him. In those days, if the men had any grievances, they could have a talk with the "old man," as managers were then called, to settle their troubles. Today, the manager no longer has time to encourage the workmen with a greeting or handshake. Instead, he very often hands the workman a printed notice; there is, therefore, little or no personal touch between the two. It is, however, far from possible for a manager to cater to the interests of each individual, or to settle all grievances among his men, and still keep his mill running. Even should he try it, he would soon find the day far too short to accomplish all his work. At the same time the men who were not given consideration would soon feel that partiality was being shown by the management. For this reason, it has become necessary to divide men into groups and to place one man, the foreman, who is directly responsible to the manager, in charge of each group.

MANAGER'S RELATION TO FOREMEN

A manager should be a man who has a mind of his own, and should be capable of aiding in making decisions by the foremen. If he is a man who is easily influenced by smooth talk, the chances are that some of the foremen will take advantage of him. This will lead to hard feelings among the foremen. Therefore, several important items for him to consider are: First, to endeavor sincerely to give his foremen a square deal; second, to treat them as partners in the business; third, to give much thought and energy to their training.

When a manager promotes a man from the ranks or employs a new foreman, he should call a meeting of all of the foremen. At the meeting he should introduce the new man, announce his position, and ask all of the foremen to co-operate with him in helping the new man to get acquainted with the conditions of the plant. The manager should outline the work for the new man and explain fully what is expected of him. If the foreman is employed from another mill, it should not be taken for granted that he knows his job. Regardless of the kind of work and the similarity, there are no two plants in which the conditions are the same,

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and it takes a new man several days to become adapted to the new environment.

SELECT FOREMEN WHO RESPECT SAFETY

If the manager chooses careless foremen, he cannot expect to operate his plant on a safe and efficient basis. I would say that the manager is directly responsible for the safe and efficient operation of his plant, because he is the one who chooses the men for the heads of his various departments. This is not an easy task, for foremen should be placed wisely in regard to safety as well as skill. It may be that a man is specially qualified to deal with electrical hazards, or chemical hazards, for instance. This should be taken into consideration, unless the organization is so arranged that the safety engineer is responsible instead of individual foremen.

Every plant should have an auditorium or some available meeting place for managers and foremen. Meetings should be held at least once every month with the honest intention of the manager to give his foremen a square deal. At these meetings, subjects of operation, safety, and new problems should be discussed. Experiences, statistics, and reports should be compared. This gives the foreman pride, credit for work well done, and furnishes a stimulant for better results and perhaps a higher goal at which to aim. This place for meetings should not be for foremen alone; it should also be for the representatives of the great mass of workingmen. What the workingmen really want is self expression, and they should have the right to discuss and share in the adjustment of matters affecting their own interests.

SOME QUALIFICATIONS OF A GOOD FOREMAN

A good foreman possesses a pleasing personality and is not a "grouch." He should be a leader of men and not a driver, for the days of driving men are past. An amiable man can get more co-operation from his men than the one who would be termed a "bully." It used to take a husky man to be a foreman, but today it takes a quick witted man, who can understand human nature, who treats every man as an individual and does not regard human labor as something which can be bought and sold as are machines and raw material. The foreman should be well enough acquainted with his men to be able to call them by their first names. An employee usually feels nearer to you, if you can call him by his first name or his nick-name. A distinction should, however, be made between friendliness and familiarity on the part of the foremen.

The responsibility of his men's work rests upon the foreman; consequently, he must be responsible for their actions. When a foreman takes on a new man, he should call all the men of his department together, and introduce the newcomer to them, and then explain to him just what is expected of him, the working hours, etc. The next step would be to take the new man through the mill, point out the dangerous places, and then allow him to work for a few days with another man who is thoroughly familiar with the plant. Thus the liability of accidents would be reduced.

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Safety has to do with the safeguarding of human lives. No phase of the foreman's work is so important as this. The foreman should be made to feel that he is a protector and that his mistakes are apt to be sad ones. He should be kind-hearted, patient, and quick to see things which endanger life and limb. It is also the duty of the foreman to make material conditions so safe that the workmen can do their tasks without having to exercise abnormal care. After the new man has started working, the foreman should study him carefully to see if he is fitted for the place and to learn whether he is reliable or careless.

FOREMAN SHOULD SELECT WORKMEN

The foreman should have the responsibility of selecting his men. This should be the case in every mill, although there may be an employment bureau which hires and fires the men. In no plant should the foreman be compelled to take a man sent him by the employment bureau against his wishes. Although the candidate might be a good man, in some cases it would be impossible for him and the foreman to agree. If a foreman does not act in harmony with one of his men, he should report the fact to the employment bureau so that the man may be transferred to another department. Good work cannot be expected where there is discord.

FOREMAN SHOULD ENCOURAGE SUGGESTIONS FROM WORKMEN

A foreman should always be glad to explain the best way of doing work to his men. If the men are unfamiliar with the work, he should show them that he is not afraid to work, but should always allow the workmen to solve problems for themselves. He should always be open to suggestion from his men and always encourage self-expression, because there are many capable men under the foreman whose suggestions might prove valuable, because they are in the thick of everyday battles, where suggestions naturally arise of which the foreman would never think.

The foreman is directly responsible to the manager for the safe and efficient operation of his department. His responsibilities are of a smaller scope because he has fewer persons and fewer machines under him, but his task is more difficult because he has to deal with less intelligent labor.

CHAIRMAN WILLIAMSON: I will name as the nominating committee, Mr. William F. Dewey, of the B. D. Rising Paper Company, chairman; and Mr. W. E. Howard, of the Oxford Paper Company, and Mr. J. H. Reilly, of the American Writing Paper Company.

The next paper is by Mr. Frampton.

USING A CAMERA TO PROMOTE SAFETY

A. E. FRAMPTON, EDITOR, "THE HAMMERMILL BOND," HAMMERMILL PAPER COMPANY, ERIE, PA.

There are but three major ways of communicating thought: by speech, by the written or printed word, and by picture language. The safety

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movement uses all of these, and uses them extensively and intensively. We find enthusiasm engendered by capable speakers addressing the men in our plants and shops. We use our newspapers, our general magazines, and our plant papers in an effort to concentrate the thought of the average man upon the problem of personal safety. Through bulletin boards and plant magazines we employ the picture language to further impress the mind with the necessity of personal carefulness.

It is with this last means of communication, the use of the picture, that I want to deal. I believe that it is a powerful agent for the transmission of safety thoughts. I believe that on an average it can be used to a larger extent than we see it used. There is a virility and force to a well executed drawing or a well-posed photograph that has a universal appeal. The marvelous growth of the moving picture industry is a tribute to this strength of impression, this ease of understanding.

There is another side to the use of pictures which is worthy of thought. Those who work in our great industrial establishments are in many cases un-lettered. They read with difficulty, maybe not at all, but they can understand the moral of a photograph which shows perhaps their fellow workman, John Jones, posing in some dangerous practice which all should avoid.

ALL MEN UNDERSTAND PICTURE LANGUAGE

You are acquainted with the phenomenon of a blind man identifying a dollar bill by running his fingers over it. The answer is, of course, that the loss of one of his senses has intensified the ability of another sense to receive impressions. Now this same thing takes place with your illiterate workman or your man who has difficulty in reading. Being somewhat shut off from the accumulating of ideas in one common manner, he becomes more acute in receiving ideas through other means—if he cannot read the words, he gets all the more meaning from the picture. This means, of course, that pictures used to preach safety must be true, must carry their lesson clearly, and must avoid anything which might detract from the force of the lesson you wish to impress.

It is not possible for many of us who are turning out safety bulletins or spreading the word of safety through plant magazines to have the services of a skilled and understanding artist, but any of us can use a camera and by using it add mightily to our message of safety.

USE OBJECTS OF GREATEST PERSONAL INTEREST

Do you know of anything as interesting to you as yourself? And next to that, of anything as interesting as the human beings with whom you are closely associated? It is rather certain that you do not. Then why not use these fundamentally interesting people in getting across your safety message? Bill Smith is very much interested in Bill Smith. Very well then, have Bill pose at his work in some manner that will portray a thought for safety. Of course, you cannot have Bill in every safety picture, so you will have to do the next best thing and use on occasion those with whom he is directly in contact. Have his side partner, Jim

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Brown, pose another safety lesson. If you will keep this up over a period of time, using these local interest safety photographs on your bulletin boards or in your plant magazine, you will get attention to them from the very ones whom you wish to impress, and you will perform an incalculable service in the interest of carefulness.

Let me suggest that you keep a little note book of safety ideas particularly applicable to your local conditions. Take a camera and your note book and go around your plant. Look for suitable backgrounds, preferably places which give you fear of accident, or places where accidents have happened. Call your workmen who have to do with these places. Explain to them that you wish to portray to everyone in your establishment the danger of this place, and have your men act to expose this danger. When you put this picture in bulletin form or in your plant paper, be careful to say that the men in the picture understand the danger and that they are acting for the benefit of their fellows. If you have never used such bulletins or pictures, I believe you will be agreeably surprised at the reception they will receive in your plant. They tap the two fundamental interests of the men—self and associates.

WHAT PICTURES WILL DO

We feel that the use of the camera has been a valuable adjunct to the work of our safety director, and, indeed, he is enthusiastic over it, and gives much thought to the best use of this medium of safety preaching. We use the camera to portray dangerous places and dangerous practices. We use it to teach the right way of performing a piece of work as opposed to the wrong way. We use it to praise the man who has performed some conspicuous service in our plant for the cause of safety. We use it to impress upon the minds of our men that our first-aid dispensary and first-aid kits are for use freely and promptly. We use it to portray new safety work which has been accomplished, so that we may impress the workman with the fact that our management is keenly alive to his value as a human being, not merely as a producing unit. All these ideas, and more beside, may be developed in your own plants.

Now just what sort of equipment should you have for getting these pictures? Any camera will do, even the simplest. If you must take inside photographs, get yourself a hand flashing outfit, or learn the time exposure capabilities of the machine which you use. There is just one rule in taking pictures, that is, to keep within the capacity of your lens. If you have a cheap camera, don't try to set up a background that only a graflex could catch; but get sunlight to help you. It isn't the camera nearly so much as the judgment you use, the locations you select, and the care you take in arranging your subjects, that is responsible for success.

SUGGESTIONS FOR SUBJECTS

Now, just to suggest a few of the subjects which we have used, in order that you may see how the camera idea may serve you. Here is a photograph of one of our men whose loose coat-sleeve caught in a revolving

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shaft. His coat was torn from his back and only his presence of mind in bracing himself against the frame-work of his machine saved him from serious injury.

Again we have a little drama in which three of our Italian-born laborers take part. Pietro is wielding a pick. Sam, a new man, carelessly comes up behind him. Pasquale seizes Sam and draws him out of the way of the flying pick. These men take great pleasure in posing for this picture. They receive a strong lesson themselves and impress the point of their playlet upon the minds of their fellow countrymen, many of whom are doing the same work as they.

Next, we have just one of many pictures showing a man whose eyes have been saved by wearing goggles at his work. Then we find a batch of unsafe ladders by turning the safety committee loose in the mill in quest of them. We round up these killers, pull loose a few of the more dangerous rungs with our bare hands, and take their pictures. We take advantage of the opportunity also to have some of the men pose in positions which may befall them if they use the bad ladders. Some of these pictures were borrowed from us for the National Safety Council bulletins.

Around a paper mill there are to be found tubes, rolls, cores, pipes, shafting, and hosts of other round objects which may roll when stepped upon. We have one of the men posed taking a spill on a lot of shafting.

In passing through the mill we find a safety guard removed from a circular saw. We take a picture of the saw just as it was left, and use this photograph with a little sermon in our plant paper.

CATCHING THEM UNAWARES

Going through a broken train is a lot shorter than walking around it, or going up to the crossing. So once in a while, just to keep our men in mind of the danger, we go alongside of a freight train and take unposed pictures of men passing through a broken train that is being switched.

We find a man sitting on the sill of a second story window. We take his picture and use it in a bulletin. Then, to make sure the practice will not be repeated at that place, the safety director closes up the window with a grating.

We have a good first-aid room. It is for use, and the more it is used the better we are pleased. So we have one of the men pose having a damaged hand bandaged by the first-aid nurse. This, frankly, is a bid for trade, and we find that such pictures increase the patronage of our first-aid dispensary, and reduce lost time from accidents.

You are all acquainted with the way the pulp pile dries and settles on the outer edge, arching over at the top. Our workmen are acquainted with it, too, but we find no harm in reminding them of the danger and in telling them to keep away from pulp piles that look the least bit dangerous. Hand axes, picks, pickaroons, etc., take their toll of injury in every pulp mill. So we never tire of showing the various ways that these objects may cause injury if handled carelessly, or left around carelessly.

The foregoing are merely a few of the ideas which have been used and

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which may be used. They are indicative of the broad scope that a hand camera has in a pulp and paper mill. We have never yet run out of appropriate subjects for our camera and we do not expect to in the near future.

EVERY PICTURE SHOULD CONVEY A MESSAGE

After you have your pictures taken, you, of course, must have them made into cuts, unless you intend to use them only on safety bulletins. In either case the use of glossy paper for the prints is preferable to the flat-finished paper. There is greater detail in a glossy paper, it is more readily re-photographed by the engraver; and if used in a safety bulletin, rejects dust better than the duller-surfaced paper. In having cuts made from the photographs you may find it occasionally advisable to have the engraver silhouette the acting figures, leaving a background of white paper. On the other hand, a well chosen background of a part of your own plant may give the local impress that will strengthen the lesson of your picture.

In summing up, there seems to be one vital thing that must never be forgotten: First, have a message, and get it clear in your own mind, or you cannot transmit it clearly to other minds. If the idea which you wish to carry is not specific in your own mind, how can you expect it to be forceful in the photograph which you take to portray it? If you have not been using a camera in conjunction with your safety work, you may find that the judicious use of a spool of film a month will add considerably to the effectiveness of the other means which you utilize to impress the message of safety.

DISCUSSION

MR. DANIEL J. DALEY (Brown Company, Berlin, N. H.): How do you get your information regarding the dangerous places?

MR. FRAMPTON: I work in conjunction with Mr. Gleason, the safety director. In taking these pictures, we go out together. We know, from reports of accidents, from reports of the safety committee, from meetings of our mill safety council from suggestions which come from the men, from reports and suggestions of the state boards and the insurance companies, what the places are that cause the trouble. By working in conjunction that way, Mr. Gleason furnishes the practical side of it, and I furnish the mechanical ability to get the set-up or back-ground to impress the lesson; so it is a matter of co-operation. However, you may find that you will have amateur photographers in the mill who will give you such pictures.

A MEMBER: Since the first of January I have made almost a thousand photographs in my work with the Standard Oil Company, so that shows the extent to which I am interested in this subject. There is one feature that I don't think the speaker mentioned, and that is the use of photographs in talking with the foremen and department heads. There is something unanswerable about a photograph. If you can get a photograph out in the field and then go up to the foreman or head of a department and say, "Look here, why is this?" you have done something that

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is going to start him to thinking, and something that is going to sell him the idea of safety much quicker than anything else. And more than that, the idea of the use of photographs in selling to the worker the idea of safety is very important.

I have slides made from our films. You can usually get the slides made for about 35 cents apiece, and you can get a projector very cheaply. Then you can go to small groups of men during the lunch hour and show them the slides. They recognize the pictures, and while showing them the slides ask them questions. Don't make a speech. When you ask a person questions, you will find out whether he intends to answer the question or not, he starts thinking of what his answer would be if he were going to answer it, and when you start people thinking how they are going to answer you, their attention is focused on that idea, and you are going to get them to thinking of safety and make things much safer. That is a feature of the use of photographs which I don't find many safety men use. They don't have slides made, because they don't realize how cheaply it can be done, and how effective it is.

Another point I want to emphasize is the importance of showing conditions to the plant management, the president, or members of the board of directors. You would be surprised to know how interested those men are in plant conditions. They don't get out into the plant; they don't see it, and they don't know. If you show them photographs of conditions you are selling them the idea of safety and getting them interested.

I couldn't do business without the camera. I never go out without the camera being with me. If you want to get a camera, get one with a good lens. It doesn't pay to get a cheap lens, because you want something that will do the work. And you must instruct your people to make photographs that tell a story. I have had many of the men who were interested simply take snapshots that didn't mean anything.

Mr. W. E. Howard (Oxford Paper Company, Rumford, Me.): We went into this bulletin game something like two years ago, and we have made up our minds that our biggest work in the bulletin line is to get the men to appreciate those bulletins, to make them attractive and bring them to their attention so that they will get them well into their minds. When we first started out, we used to get bulletins, like the rest of you, once a week, and then we would sort out what we thought were applicable to our local conditions and then we would take down one set and put up another; but I made up my mind that we weren't getting the results the way we should. We painted our bulletin boards black, making them about 30x36 inches, put a good light over them and then polished them off clean and left them bare for a week. By that time the men were beginning to inquire whether we had gone out of the bulletin business. We didn't say much about it, but we got a good set of bulletins, and put them up, and the men took notice of them, and we have made a practice of doing that ever since.

We have used the bulletins of the National Safety Council and also those of the local works. We put those up and leave them for a while. We don't have anything else put on our bulletin boards except the safety bulletins and when we take those down and leave the board bare for a

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day or two, the men are all watching to see what is coming next, and we are getting results that way.

MR. FRAMPTON: I would like to say one word about the camera. The gentleman from the Standard Oil spoke of the advantage of getting a good camera, the best possible, and I would advise the same thing. If you can get a camera with a 4.5 lens by all means get it, and you will come nearer to getting good pictures, but don't be discouraged if you haven't a fine camera, because you can get worth-while pictures which will teach the safety lesson with *any* camera you have.

Cameras using plates or film packs have the advantage of making it possible to take and develop immediately one picture at a time, instead of waiting till a whole roll of film is used before finishing any of the pictures.

It is often a distinct advantage to have a high-speed lens. The ordinary newspaper graflex is generally equipped with F-4 or F-5. If you want speed, buy nothing slower than F-6.3. But you might as well put some more money into it and buy a high-speed lens, such as F-4.5 or F-5.

CHAIRMAN WILLIAMSON: Last June I had the pleasure of visiting the new pulp and paper mill of the International Paper Company at Three Rivers, Quebec, and I noticed, as I was about to enter the plant, a large bulletin board with safety bulletins on it, a home-made affair. They were excellent bulletins; they had the personal appeal, and the camera had been used to full advantage in preparing them. We can all use the camera, and we can make up other bulletins without the camera. There is nothing which will appeal to our own men as much as a bulletin made in our own plant, providing the bulletins are properly worked up. I would advise or suggest that as many as possible try that method. I have tried it myself and found it very successful. After you have done that, send those bulletins in to the chairman of our bulletin committee so that the section may have the advantage of them.

We will now proceed with our next paper, by Mr. Al. Kroes.

DIRECT HITS IN SAFETY

AL. KROES, DIRECTOR OF SAFETY EDUCATIONAL WORK, EMPLOYERS' MUTUAL LIABILITY INSURANCE COMPANY, WAUSAU, WIS.

It is with genuine pleasure that I come before you with a brief message on safety, a subject which is as old as the hills, but which got real teeth in the year of our Lord, 1912, or thereabouts. I do not know how this problem is handled "way down east," but up our way we handle it without gloves, strip it of all tinsel and finery and go to it rough shod and with direct hits.

My friends, not all knowledge of this safety problem is to be found in books with handsome bindings and gold-lettered titles. On the contrary, the real stuff that counts must come from the man on the job and the co-operation of these men with the management. You will admit that these fellows have ideas, real worth-while ideas on safety. To pry them loose we must approach them with direct hits and make them think

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in time. Some of the most serious accidents occur when a fellow's "thinker" is out of order or doesn't function when it should. The mind is like a cutting tool. When used constantly, and sometimes monotonously, it becomes dull and incapable of quick thinking. Therefore, we should shake up the old bones once in a while and get busy on the safety subject in some form or another. The presentation of Safety First through a monotonous array of figures or statistical references leaves the workman cold. It excites no interest in him.

HOW TO MAKE DIRECT HITS

Direct hits are the thing. You all remember the experiments by the U. S. navy when they bombed the ex-German battleships. Almost a hundred packages of TNT fell all around the erstwhile prides of the German navy. They made a lot of fuss in the briny deep, but it was left for the *direct hits* to do the business. We all have memories of the aimless safety campaigns in the average factories. Hundreds, yes, thousands, of safety packages are dropped from up high, only to fall in the water clear from the real object. They make a beautiful display but miss the effectiveness of a direct hit.

How then can we make a direct hit with the worker on the job? In the first place, get on the level with him. Cut out all bombastic, flowery language. Come down to the grade level with your listener so he can get you. Use barnyard language—a bit of slang, if you must. It will appeal to him. Of course this will shock Boston, but it works!

When you talk to a body of safety engineers, go ahead and use technical phrases to your heart's content. They like it and grow fat on them, but when you face a group of workers, whose educational clock has stopped with the eighth grade don't talk to them on *relativity of the accident percentage* between one shop against another or perhaps one industrial group against their brothers. Don't try to make them like it. It can't be done.

Don't be afraid of being too commonplace. Hit right from the shoulder and be cheerful. Keep in mind that you are talking to John Kalinski—not to President Harding. You keep them on the alert and their minds are receptive every minute.

BE A "PEPTOMIST"

The method I am using for my company is pictorial. For regular evening safety parties we use moving pictures, slides, and the singing of safety songs by the men, their wives, sweethearts, brothers, sisters, and all the kids. For day sessions we are using cards, pictures, slogans—anything to focus attention on the speaker. By all means use the old "*pep*." Be a "peptomist." What is a "peptomist"? He is the last word in getting things done. He belongs to the triplet aggregation of the optimist and pessimist. The pessimist will say "No, I think it can't be done." The optimist comes in and says "Oh, yes, I really think there is a chance." But the peptomist—Oh, boy! he says, "Gangway, fellows, I'll do it!"

Ring in a story. Don't try to set your face into wrinkles of dignity, like Professor Einstein before a group of scientists. When they laugh at

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your story, laugh along with them. After a session of seriousness, laughter is a good shock absorber—a drop of oil on the hot journals of life. Laughter, my friends, jiggles the diaphragm, it tickles the liver, it lessens sorrow, it accelerates the circulation, it promotes digestion and lubricates the serious human machine.

Safety is a subject we all believe in, but which in this speedy and complex life we are apt to forget. We all came to Boston to use this great Congress as an interchange and clearing-house of ideas, and if there is something worth while in these remarks I hope that you may carry it along to your respective places of industry.

To do this with telling effect I have here my pictorial lesson used to portray vividly the hazards of shop life to the worker. It is a chatty, neighborly talk full of good will and snappy as a live wire. I will now ask you to grant me the time to put in a few direct hits.

(About 15 cards are shown and explained in detail. The pictorial exhibit deals with elevator hazards, hints to keep safeguards in place. A group of pictures on infection results in a vivid lesson on the use of goggles and the effect of serious accidents on the home life of the worker.)

APPEAL TO MAN'S LOVE OF HOME

In conclusion—whatever else a man may be, whatever his thoughts and ideas on safety, you may be sure that you can get very close to him on the home question. You have and I have met a lot of fellows who ran amuck with the hammer, knocking the safety movement. No argument could reach these birds. But away deep in their hearts is stored away the natural love for their homes and those they hold dear.

And there, gentlemen, lies your great opportunity. The noblest work in all the world is waiting around the corner. These indifferent men *must* be appealed to. Safety is a wonderful creator of good fellowship in a workshop. The great Christian lesson of being your brother's keeper should be written in letters of gold in every place of industry, from the office down. When the worker finds a place on your payroll, hand him a package of Safety with his time-clock card. Don't stop there. Follow him through the shop, guide him over the rough places, take a real interest in his welfare, and cling to the human side of the employment contract. If you can't oil the safety movement yourself, give the oil can to some other fellow, but be sure to get someone who is imbued with those ideas. Then the safety problem, as far as your shop is concerned, will be solved.

And *your* reward? Last, but not least, you'll have that feeling of lasting comfort and pride, that you have in some measure contributed to the better conditions safety is sure to bring. You have hastened the dawn of a better day.

ADJOURNMENT.

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WEDNESDAY MORNING SESSION

CHAIRMAN WILLIAMSON: We will have the paper by Mr. Walker, which in his absence will be read by Mr. O. M. Porter.

BEATER ROOM HAZARDS

CHARLES WALKER, EMPLOYMENT MANAGER, EASTERN MANUFACTURING COMPANY, BANGOR, ME.

The degree of safety attainable in the paper mill of today is dependent upon three things: the superintendent of the mill, the type of men hired, and the safety engineer. The superintendent must be heart and soul in favor of safety work so that there will be no opposition to spending the small amount of money necessary to keep a beater room safe. The men selected for beater work must be of a type high enough to appreciate the value of the work we are preaching. The safety engineer must be big enough to put across safety policies in the face of severe opposition. The presence of these three factors will be sufficient to enable the safety engineer to reduce beater room hazards to a minimum and almost to a negative quantity.

You all realize, I think, that present day beating engines are very nearly fool-proof. Mr. J. J. Sullivan, who is one of the pioneer paper makers of the country, asserts that he knows of no case where a man has been killed or seriously injured by a beating engine, except when the beater rolls were being removed by repair crews.

Minor dangers are always present, like poor relatives, and it is against these that we safety engineers must be continually fighting. Pulley driven lines, for instance, must be most carefully guarded. Motor driven lines must be ever so carefully watched, for the beater room being more or less wet is a wonderful conductor. One man only should be permitted to wield a fork in cases where shavings or centrifuge is dug from boxes.

A custom formerly practiced was that of weighting down the valve when the next beater on the line was being dumped. This should never be done. In England there was such a case, and the weight went under the roll, the roll jumped off, snapping a belt which killed two men.

You should see to it that your stock and machine chests are adequately protected. You should see to it that the covering over them is sufficient to prevent men from falling in. You should be particularly sure that all gears are covered.

Probably the greatest flaw in the old time beater room is their wooden floors covered with boiler plate in the trucking alleys. I venture to state that there have been more beater room accidents caused by slipping on wet plate, causing ruptures, sprained ankles, and straining of back muscles than from any other cause. If you are building new beater rooms, advocate concrete floors with inlaid steel reinforcement, for they will pay for themselves many times over on the insurance rates.

Trucks designed so that leverage is created by two or three men pressing down on the handle in order to raise a platform from the floor

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should be carefully inspected by a mechanic every few days for when these handles fly back, as they frequently do, that man who is unfortunately in its path would better be in the front line trenches.

Some of you are perhaps using electrically driven trucks for the transportation of beater room materials. Very little may be done to better this modern phase of trucking except to see that bells are in good condition and that defined traffic rules are laid down.

Elevated tanks of all varieties, such as alum, size, and water containers must be sufficiently guarded by railings, and platforms with toeboards. The ladders leading up to them should be of steel wherever there is no danger of their becoming electrified.

Many strange accidents take place in the beater department of a paper mill, most of them due to carelessness, but the most unique one that we have on record is the case of a man who was washing out a beater with a line of hose. Now in his enthusiasm to get the beater clean he allowed the end of the hose to get under the beater roll which was running at the time. Inch by inch he contested the destruction of the hose until at last he was pulled from his precarious position on the edge of the beater into two feet of water, and if he had not been obliged to strike out with his arms would probably have met the fate of the hose.

Most of you people plan your own campaign for getting your policies across, but we have found that the best move for safety lies with the employment manager. That much loved and much hated individual has the power either to make or break safety work, as his poor judgment in hiring men who are unable to comprehend what we are all working for has caused thousands of dollars in accident claims, and vice-versa.

May I give you just one piece of advice regarding this subject? When you go home, make your employment manager hire men who will be safety men from the time they come to work until they go home, and you will find that 75 per cent of your troubles end right there. Let us all try to have nothing to hinder our teaching safety first and always to the men.

DISCUSSION

CHAIRMAN WILLIAMSON: There is just one statement in the paper to which I would take exception, and that is that so far as known no men have been fatally injured in the beater room. I think that within the past two years we have seen in the paper trade journals an account of a beater helper going under the roll, and you can imagine that there was very little left of him. That occurred in one of the mills in the eastern part of the country, I believe.

We will now have the report of the nominating committee.

MR. DEWEY: The nominating committee makes the following nominations:

For Chairman—Mr. Walter A. Gleason, Hammermill Paper Company, Erie, Pa.

For Vice-Chairman—Mr. Adam Wilkinson, American Writing Paper Company, Holyoke, Mass.

For Secretary—Miss Emilie Raub, Dill and Collins, Philadelphia, Pa.

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(The report of the nominating committee was unanimously adopted and the officers nominated were duly elected.)

CHAIRMAN WILLIAMSON: We will now proceed to the paper by Mr. Taylor.

VENTILATION OF PAPER MILLS FROM A BUILDING AND SAFETY STANDPOINT

H. S. TAYLOR, CHIEF ENGINEER, MANAGEMENT ENGINEERING AND DEVELOPMENT COMPANY, DAYTON, OHIO

Although we find rules and regulations being laid down for ventilation of school houses, hospitals and other public buildings, no concerted movement has as yet taken place to so provide for industrial plants, or other structures where the greater number of our male population, and a fair proportion of the opposite sex, spend their working hours. To be sure, the subject of ventilation is one of importance in many industries, but study has been made and improvements perfected as an aid in the betterment of product, and not with the safety or health of the operators in view. A man who works in a poorly ventilated department is not at his best. Conditions may be such that they do not impair his health, but at the same time they do impair his efficiency, and this impaired efficiency is a liability to the firm for whom he works. If this workman is a machine hand, where at least normal precaution must be taken to prevent accident to himself or to fellow workmen, impaired efficiency must be a reaction of this man's mental, as well as physical system. With his mental system impaired, the quickness of those senses controlled directly from the brain that warn us of danger, fail at a critical time, and either a minor or major accident results.

GOOD HEALTH TENDS TO REDUCE ACCIDENTS

Through the health of the workmen we can, to a great extent, improve his chances of avoiding accidents. In other words, the better the health, and thus the condition of the human being, the more alert his senses are to the dangers surrounding his occupation, dangers that might cause accident to him alone or to his fellow workmen as well.

The modern paper mill is a good example of an industrial plant where ventilation is a necessity, and where the owner can realize material savings on both manufactured product and the efficiency of the operator. In the paper mill itself we have the machine room, where a process of evaporation in great magnitude is carried out. We have the beater room, where a much less quantity of moisture must be removed, but unless this room is properly ventilated condensation and deterioration will take place, especially through the winter months.

In the groundwood mill we have the grinder room, where the grinding process generates and discharges a considerable quantity of heat in the form of vapor, and the process is such that the areas in which the workmen must be stationed are saturated with water unless proper means of removal are resorted to.

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In the sulphite or chemical pulp mill we have the buildings housing an acid system, blow pit, and digester house, where, unless proper means of ventilation are taken, SO_2 gases and moisture remain within the buildings and work their deteriorating effect on the structures as well as the workmen.

EFFECTS OF POOR VENTILATION ON HEALTH OF WORKMEN

The workman who must spend eight to twelve hours a day, or even longer, in a room the temperature of which may be 80° or over, and the atmosphere saturated with water, must feel the effects each day, and in a long period such conditions must show their effect upon his entire system. In the mills located in the north country the workmen must, after spending their shift in this extremely high temperature, go out into a temperature which may be 40 degrees or more below zero, and such a condition can only be resisted permanently, without at least some ill effects, by the strongest constitutions. Under such a condition, more than any other, adequate means should be taken to ventilate the building properly, thus preventing the high temperature and removing the moisture-laden air through positive removal and admission of fresh dry air in sufficient volume.

The condition of extremely high temperature is found only in the machine room, but the moisture-laden air is everywhere prevalent; and in the sulphite mill gases, if not removed, will work their injurious effect on the men, if they must remain constantly within the affected areas. It is a known fact that SO_2 gases in quantity will, if given sufficient time, destroy the hardiest plant life. Will they not then have at least some effect on human life within the mill?

From the standpoint of ventilation, the machine room is the most important. The groundwood mill and sulphite mill rank second, and the beater room, wood room, and other such departments last. For example, we will take a two-machine room with a normal production of 100 tons per twenty-four hours, the sheet going to the dryers 33 per cent dry and to the reels 95 per cent dry. With this operation we find that for each pound of production, 1.95 lbs. of water is evaporated at the dryers; and for each 100 tons of production per twenty-four hours, a total of 390,000 lbs. of water, or 270 lbs. per minute, is discharged from the dryer section and must be removed from the room in the form of saturated vapor. This is in addition to the moisture rising from wire, flow-boxes, etc., which, while low in quantity, is also at low temperature and therefore practically at the dew point.

AMOUNT OF VAPOR TO BE REMOVED AND REPLACED WITH DRY FRESH AIR

With the foregoing conditions existent within the room, the removal of this 270 lbs. of vapor per minute must be accomplished, together with the replacement of a corresponding volume of dry fresh air. This question of replacement is by far the more important in that no matter how great the capacity of the exhaust equipment installed, removal will not take place unless replacement air is in such volume that there is an even balance within the building. If the moisture-laden air is not removed, the

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temperatures within the room will be exceedingly high, and the air will be saturated with vapor giving the cloudy, thick appearance so commonly seen in paper mill machine rooms. In cold weather the vapor frequently turns to fog. The men who must operate the machines, after remaining in this atmosphere through the greater part of the shift, feel the heat and high degrees of humidity, and it stands without question that they cannot carry out the work required of them as efficiently as they could with the atmosphere dry and clear. Under these conditions, far less attention is given to their work and to keeping their arms, legs, and other parts of their bodies at a safe distance from calendar rolls, pulleys, and other movable parts that cause loss of life and limb when contact takes place.

For the machine room a system of exhaust fans properly connected to the hood over the machine will remove the entire moisture content that arises from the paper machine, and to complete the system a heating unit consisting of heating coils and positive fans must be installed in a location where fresh air can be admitted. This replacement air, as we will call it, should be distributed through air ducts of correct size to all parts of the room in proportion to the air changes required in different sections of the building. For the best distribution, delivery piping should be carried through roof trusses, with outlets discharging one-third of the incoming air upward to the roof and two-thirds downward to the room.

Regulation of this system depends almost entirely upon the steam valve to the heaters. The moisture content to be removed is approximately the same whether it be a hot day in summer or a cold day in winter. In cold weather, however, the incoming air must be heated to prevent the temperature of the moisture-laden air that it meets from dropping below the dew point, and the amount of steam to be heated depends, therefore, on the temperature of the outside air that is drawn through the coils.

RELATION OF BUILDING CONSTRUCTION TO VENTILATION

A word might be said here as to the effect of the type of construction of the machine room on its ventilating properties with the system under discussion. It can readily be seen that with a low outside temperature, the incoming air must be heated to prevent condensation, and, further, efficiency of the system must depend on the retention of this heat within the room; therefore the lower the conductivity of the enveloping structure, the greater the retention of heat units, and what is more to the point, coal in the bunker. Paper mills of any size are now built of fireproof construction, employing concrete, steel, brick or tile, except as regards roofing material, where wood has been the standard material to a great extent and through a wooden roof the largest number of heat units are lost.

For proper lighting effect, especially for a room containing two or more machines, it is without doubt necessary to install skylights. The skylight area, however, should be held to a minimum due to the high conductivity of glass and resulting heat losses throught it. Glass areas in the walls should be designed with a view of admitting sufficient light

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but not more. In a large number of paper machine rooms window glass covers a large area, and this large area is in inverse ratio to the size of the coal pile at the end of the winter season. In other words, protect the interior of the machine room from outside temperatures to as great an extent as compatible with cost of construction. As an example, an air space can be left in brick walls with little extra expense, whereas in a concrete wall an air space involves an expenditure that is prohibitive, but wherever air spaces can be left, insulating qualities are greatly improved.

The computations as regards heat units required in incoming air, volume of removal and replacement air, and other finer details of the system are not given in this article, in that this paper is written more as regards the effect of ventilation, than on the details of the system itself. For the benefit of any reader who might wish figures, I can refer him to an article on "Ventilation of Paper Mill Machine Rooms" given before the Technical Section of the Canadian Pulp and Paper Association in January of this year, and published in the *Pulp and Paper Magazine of Canada*, Volume XIX, February 17.

GROUNDWOOD AND SULPHITE MILLS

The ventilation of a groundwood mill and sulphite mill is to a great extent similar to that for machine room, except that no such quantities of replacement air are required. Exhaust equipment should be connected to the grinders in such a way that steam and other vapors arising from the stones and troughs will be removed from the building, and a fan unit consisting of heater and fan should be installed, of a capacity that will replace cubical contents removed. The volume of replacement air for grinder room to supply groundwood for a paper production such as assumed for the machine room referred to will be less than 25 per cent of that required for the machine room, and a similar comparison could be made with reference to exhaust equipment.

For the sulphite mill, exhaust equipment should be installed at points where gases and moisture originate, and their removal to outside air accomplished with the least possible delay. A heating unit similar to that outlined for machine room and grinder room must be installed, but of only sufficient capacity to heat the building, enough excess air being thus allowed to replace what small volumes are removed through exhausters. In other words, the sulphite mill system would be mainly one of supplying sufficient air to heat the building in the winter season, as during the summer season replacement air can be taken through windows or other regular openings.

EFFECT OF MOISTURE ON STRUCTURE AND EQUIPMENT

Moisture, or dampness, as we all know is one of the most important factors in the deterioration of materials, more especially so in the cooler climates where alternate thawing and freezing take place, and in paper mills the processes carried out demand a supply of water by weight or volume far in excess of the manufactured product. One of the most

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important conditions, therefore, that the mill owner must have in mind is the rapid deterioration of all mill buildings with all parts thereof saturated with moisture, and while the first cost of an adequate system of ventilation may seem excessive, the owner will eventually put many times this first cost in maintenance and replacements. The statement can be borne out by the number of roofs of paper mill machine rooms that have been replaced during the past few years.

In addition to this question of deterioration of structures, there is the question of condition of the men who work within the mill, and this latter question, I believe, is the more important, in these days of progress towards ideal working conditions. Not many years ago it was a common statement to hear a paper mill operator say that a machine room could not be kept clear of moisture, and one will hear this statement at times even at this late date. It is not true, however, in any sense of the word, and the mill owner who allows his buildings to become saturated throughout with moisture, and the atmosphere in which his men must work to be of high temperatures and thick with vapor, is deliberately allowing his property to rapidly diminish in value and is holding down production through loss of efficiency in his workmen. He is also greatly increasing the possibility of accidents, and I can say without question that should this same mill owner make a thorough study of the question and properly ventilate his mill, he would be surprised at the beneficial results accomplished as regards both workmen and structures.

CHAIRMAN WILLIAMSON: The next paper will be presented by Mr. Bartlett.

HANDLING LIQUID CHLORINE

D. K. BARTLETT, EEECTRO BLEACHING GAS COMPANY, NEW YORK CITY

Chlorine in liquid form has now been used in this country since 1907. In common with all other compressed gases there are very definite and careful regulations drawn up by the Interstate Commerce Commission governing its transportation. Under these regulations there are four accepted containers in which the material may be moved, namely, those which carry 100 lbs., 150 lbs., 2,000 lbs., and 30,000 lbs. As there have been no accidents in interstate commerce since the regulations have been in force it would seem proper to assume that the regulations are right, as they now stand.

The use of chlorine has become very widespread through the textile industry, the public water supply system, the flour industry, the chemical industry, and the pulp and paper industry. Liquid chlorine is today stored in from 4,000 to 5,000 different points in quantities of from a few cylinders to many thousand pounds. So far such regulations covering storage as have been in force are simply those recommended by the producer to the consumer. Safety is of prime importance to the producer as well as the consumer, and while the hazard is much less than is commonly supposed, it is, nevertheless, sufficient to cause the producers to adhere to and recommend regulations which make the use of this material safe.

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HAZARDS OF COMPRESSED GASES

It may be well at this point to consider briefly the hazards of compressed gases in general.

As long as the gas remains in the container, it is obvious that it can do no harm, irrespective of its effect when released. It is, therefore, necessary to consider the probability of escape of gas from the container, as well as the qualities of the gas itself. An escape of gas from a container may be due to

A. a true explosion.

B. an increase of pressure, due to heat, sufficient to rupture the container.

C. leaks.

If the gas escapes from the container, the resulting hazard may be due to

1. flammability
2. poisonous effects
3. irritating effects, with interference with sight or respiration

HAZARDS OF CHLORINE

Considering now the specific case of chlorine, we can eliminate "A" since it is non-explosive. The chance of a rupture due to "B" is very slight on account of the high critical temperature of chlorine (146°C.).

By Interstate Commerce Commission regulations all cylinders and ton drums are provided with fusible plugs which melt at 158° Fahrenheit, at which temperature the pressure is about half the test pressure of ton drums at time of manufacture and a quarter of the test pressure of the smaller cylinders.

There has never been an instance of bursting of a container in transit, or in a user's plant. There have been four or five cases of the rupture of containers in the manufacturer's plant due to the presence of foreign material in the container which reacted with the chlorine. To guard against a repetition of such accidents, all manufacturers now have in force a rigid system of inspection of empty containers. Even should a container with such foreign material be filled, any trouble resulting will necessarily develop within a few hours, so that any hazard existing from this cause concerns only the manufacturer, not the user or the carrier.

There have also been a few cases of fire where a large quantity of chlorine has been stored. In each case the upward draft due to the heat of conflagration has been strong enough to carry the gas upward and cause a sufficient dilution so that the fire fighters were caused no inconvenience in their work.

DANGER OF LEAKS FROM VALVES AND CONTAINERS

This brings us to leaks. Here the evil smell of chlorine is its own greatest safety factor. Its presence in the atmosphere can be detected in very minute quantities through the sense of smell. After the person in charge of the use of the chlorine has had his first considerable whiff of chlorine he is quite ready from then on to exercise reasonable care,

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take necessary precautions and follow the instructions laid down by the manufacturers.

The next safety factor is the slow absorption of the heat necessary to evaporate the liquid into a gas. The following table gives the rise of temperature of the liquid chlorine in a tank car during a period of 96 hours:

Times	Temperature contents	Change during period	Pressure	Change during period
(start)	(—9°C.)	.....	(64 lbs.)	.....
End 24 hrs.	—2°C.	7°C.	76 lbs.	12 lbs.
End 48 hrs.	+3.5°C.	5.5°C.	88 lbs,	12 lbs.
End 74 hrs.	+6°C.	2.5°C.	93 lbs.	5 lbs.
End 96 hrs.	+8.5°C.	2.5°C.	98 lbs.	5 lbs.

HOW TO LOCATE A LEAK IN LIQUID CHLORINE EQUIPMENT

When the odor of chlorine is noticed the source should immediately be located. Never hunt a leak through the sense of smell. Always have a gas mask handy and be sure you have fresh cannisters. The mask is not apt to be used, but it gives confidence to the one hunting the leak. Have a bottle of aqua ammonia and a piece of waste fastened to the end of a short stick. Dip the waste into the ammonia and start your search. The moment you come to chlorine in the air, a white fume of ammonium chloride will appear. As you reach a denser volume of chlorine, the white fumes are denser. Thus the leak is quickly located. If this leak is in the piping, etc., shut off the valves at the containers and repair. If in the valve on the container or the container itself, and it cannot be stopped, connect the gas valve from the container to your absorption system and begin to operate. The liquid cannot evaporate in the containers, without the application of heat, as fast as the gas is absorbed in your system, and thus the leak quickly stops.

CHLORINE GAS HIGHLY IRRITATING

As to the properties of chlorine, it is non-flammable, and not poisonous, in the sense that carbon monoxide or phosgene for instance is poisonous. We can therefore eliminate No. 1 and No. 2, and confine ourselves to No. 3.

The immediate result of inhaling a large quantity of chlorine gas is the inflammation of the tissues lining the throat with resulting coughing and nausea. While it is highly irritating and extremely uncomfortable, it is never fatal—unless the subject remains for a considerable period in an atmosphere of highly concentrated gas.

TREATMENT FOR PERSON AFFECTED BY CHLORINE GAS

Should a person be affected by chlorine gas we recommend the following treatment: remove at once to the open air and away from all gas fumes. Place the patient flat on his back with head slightly elevated, and give a half teaspoonful of essence of peppermint, or a moderate dose of bromo seltzer or whiskey. This will relieve the tendency to cough and

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soothe the inflamed membranes, allowing the passage of air and promoting the action of the respiratory organs. The person affected should himself resist as much as possible the impulse to cough. A mustard plaster on the chest will give prompt relief. While there are never any serious after effects, a physician should always be called.

STORAGE OF LIQUID CHLORINE

As this discussion is before the Pulp and Paper Section we can safely assume that we are preparing to store a considerable quantity of chlorine. First let us discuss storage in either cylinders or ton drums.

The storage space should be selected with an eye to easy unloading and transfer to the absorption room. Either of the smaller cylinders may be readily unloaded from a car and rolled over a floor by one man, but if possible, overhead trolleys should be installed for carrying them. They are suspended from the trolley by a chain block and grasped by a pair of tongs made especially for this purpose. Cylinders are usually handled and stored in an upright position. Ton drums are shipped in gondola cars, each drum resting in a cradle. In unloading them it is, therefore, necessary to lift the drum clear of the car by means of a chain block and crane or similar device, after which it may be conveyed to the absorption room by either rolling over a level floor or track, or carried by an overhead trolley or industrial car. Ton drums are always used and stored in a horizontal position. The storage had best be under a roof but with outsides on a concrete floor above any possible flood line. It would hardly seem necessary to enclose the storage space to protect against unauthorized handling of the cylinders.

The large user will wish to receive this material in the 30,000-lb. container, which is permanently fastened to a standard freight car and thus becomes a tank car, and so freight is paid only on the contents. This means a very large saving in the delivered cost of the bleaching material. Thus far the major portion of the material moved in tank cars has been delivered from the car directly into the absorption system, the cars in many cases being emptied in from four to six days. Here again is a marked reduction in cost due to elimination of handling charges.

Mills using liquid chlorine, which can take tank car deliveries, should face the storage problem. There are two methods open. First, the filling of the 2,000-lb. container or the so-called ton drum, or fixed tanks large enough to take one tank car only. Both methods are now being installed for the purpose of getting comparative data.

In our opinion, the local conditions affect this problem so that a detailed discussion of the best method of storage is useless—at least at the present state of the art. The problem is, however, one which can readily be worked out for any particular case.

(Mr. Taylor concluded with a demonstration of the evaporation process, using flasks containing chlorine.)

DISCUSSION

CHAIRMAN WILLIAMSON: This question of liquid chlorine for bleaching purposes in pulp and paper mills is a growing one. Many of the mills

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have already taken up this process with success, and I know that a number of others are contemplating doing so. This seems to be an opportune time, while we have Mr. Bartlett here to answer questions, to have a full discussion of the subject, possibly from the operating and use standpoint as well as from the safety and precaution standpoint.

MR. A. H. HOOKER (Hooker Electro-Chemical Company, Niagara Falls, N. Y.): We are manufacturers of both liquid chlorine and bleaching powder, and I have been deeply interested in the comparative development of the two phases of the situation in the paper mill, and particularly interested in the safety problem of it, because it has seemed to me that safety in regard to the use of liquid chlorine was one of the factors that was going to make or break that particular industry. Any serious accident is likely to be very much of a black eye to the process.

LIQUID CHLORINE VS. BLEACHING POWDER

There are certain places where liquid chlorine is more desirable than bleaching powder. On the other hand, for all the pulp mills, and for almost all of the uses to which chlorine is being put now, where bleaching powder has been used in the past, it is a question of comparative merits, and a question in part of comparative safety. There is no question but that chlorine, as we know it in our plant, is not a perfectly safe thing to handle. It is a thing that can be handled, and handled carefully without, perhaps, extreme risk, but still with some risk. Bleaching powder, on the other hand, and the solutions produced from bleaching powder, have never caused any serious damage to anybody or to anything, though perhaps its use is inconvenient.

We are using evaporated liquid chlorine in the manufacture of a combination of toluol for the manufacture of benzoate of soda. My son, who is a chemical engineer, and who was divisional gas officer in France, was working on the chlorination of the toluol, which is just the same sort of absorption you get in the absorption of chlorine in the manufacture of hypo-chlorine solution. There was a blow-out of one of the safety valves —one of the safety plugs, and a leakage of strong chlorine gas. We shut off the liquid chlorine, and then came back and warned the men in that part of the plant, and my son got into the cloud of chlorine gas. The result was that he got out of it, dropped, was taken to the hospital, and was there about two weeks. Nothing very serious has happened from it, except that most of this summer he was away from the plant. He is back now, and all right.

CHLORINE GAS DANGEROUS THOUGH NOT POISONOUS

I am not speaking of chlorine gas as to its poisonous effect. It is extremely irritating. It is not a poison in the sense that phosgene and carbon monoxide are, but it has some of the same elements in it.

The same thing has occurred in some of the paper mills. I am thinking particularly of an instance I knew of here in Massachusetts, where one of the cylinders leaked into some one of the rooms and one of the girls was affected. I am told by my friend here that it was at South Hadley

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Falls. That is only an instance of the effect of a rather strong chlorine gas that occurred from the use of the liquid chlorine. Those things aren't serious enough to make you say, "Don't do it," but they are serious enough to call attention to the fact that there is a real danger to avoid in those things.

I will give you another instance of a thing that happened with us, which fortunately didn't do any harm, though it might have done a lot. We had about a 4,000-pound tank, from which we were filling cylinders, and a weight fell on one of the one-inch pipes running down from it, and broke the pipe. Four thousand pounds of chlorine ran out. It so happened that the wind was carrying it between our plant and that of the Union Carbide Company and across the fields, so that it didn't do any harm to anybody. But we had to stop the trains on the New York Central from going through there for a while. If the wind had been in any other direction, Heaven only knows what damage it might have done.

RISK INCREASES WITH SIZE OF CONTAINER

I think that with the 100-pound cylinders there is comparatively little danger of any serious accident in a mill, but I think that as the container gets larger the risk becomes greater. I think the risk in transportation in a tank car is serious, and yet I almost hesitate to say so. I think it is less in the ton-container, because I think a ton of liquid chlorine is lass dangerous than fifteen tons if something should happen in the way of a railroad wreck, and I think the same thing is true of a paper mill.

With the small cylinders and careful handling, it is not a real menace, if storage is provided where there is not going to be serious danger in case of fire; but I think that even where you have good equipment for using liquid chlorine from small containers, still there is danger of getting the kind of dose of gas that sent my son to the hospital.

SKILLED MEN ONLY SHOULD HANDLE LIQUID CHLORINE

Even if you have well set up equipment for using liquid chlorine, the handling of that equipment calls for a skilled man. It should never be handled by the rough workman.

With the bleaching powder proposition, where bleach is dumped into the tank, you have got a disagreeable, nasty, dirty job, but coming right down to it as a safety proposition, you know perfectly well that there is no danger. I doubt if there is any economy effected in pulp mills by the use of liquid chlorine and I am of the opinion that they would do well to stick to bleaching powder.

Many of the paper mills have used bleaching powder and some of them have gone to the chlorine because of the lack of efficiency in the use of the bleach; that is, they didn't dissolve it properly and extract the full value from it. If they had, there would have been a very different story to tell in many of the paper mills.

MR. DALEY: Is the tendency of chlorine gas to rise or to fall?

MR. HOOKER: It is a heavy gas, and its tendency would be to hang

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along the ground. If you have got a leak in your evaporation line, so that it comes into your mill in some way as a strong gas, somebody is going to try to stop that leak. He ought to have a mask on, but those fellows don't always use masks. In trying to stop that leak without using a mask, he is going to get into danger. I don't say that the gas is going to kill anybody, but somebody is going to get hurt if it gets bad enough.

MR. HOWARD: You wouldn't advocate a man handling this liquid chlorine very much without having a gas mask handy, would you?

MR. HOOKER: I would distinctly advise having a gas mask handy wherever it is used.

MR. DALEY: How large a container would you recommend for comparative safety?

MR. HOOKER: I don't know that there is much to be said as between the 100-pound and the 150-pound one way or the other, either in economy or in safety; but when you get to the larger sizes, which are not the one-man sizes—that is, the ton containers—you enter the field of greater risks. And the tank car is a still more serious menace.

MR. LUTHER R. HARRIS (Travelers Insurance Company, Manchester, N. H.): I would like to ask the speaker if the general design of gas mask as used by the army is entirely satisfactory.

MR. HOOKER: I think that the army gas mask is perfectly safe.

MR. BARTLETT: The army has a large number of gas masks which they are perfectly willing to supply at a nominal cost, five dollars each. You can get them from the Edgewood arsenal, Edgewood, Maryland, and the property officer sends you a statement which you sign, and in which you agree that you buy the mask to be used in your own plant. I think the army mask is a perfectly good mask for our purpose.

MR. W. F. DEWEY (B. D. Rising Paper Company, Housatonic, Mass.): I would like to ask Mr. Bartlett if over a period of five years he has noticed any marked tendency on the part of paper mills to change over from bleaching powder to liquid gas.

MR BARTLETT: Why, yes. Of course, this brings up a certain amount of trade rilvary, as we may term it; but I don't think that either Mr. Hooker or myself would want the matter to come into a sales talk or anything of that kind. I maintain that we can bleach your paper cheaper with chlorine than we can with bleach. This is a point at issue between Mr. Hooker and myself, and we are quite prepared to discuss that with each of you individually. But it is largely a matter of safety as, I understand it, that we are discussing. Now, either God has been awfully good to the liquid chlorine manufacturer, or else the hazard is not so great as people feel.

MAINTAINING BALANCE BETWEEN ECONOMY AND SAFETY

Now, don't forget this side of it for a minute: In the first place, this commodity has been in use since 1907 in one form or another, mostly, in that time, in the small cylinders, but it has been handled for five years now in large quantities and in tank cars, and the accidents have not taken place. As I see the situation, there must always be some balance between economy and safety. Certainly, for complete safety, the

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safest thing for us to do would be to eliminate the automobile and thereby eliminate the gasoline hazard. If you study the statistics of the Bureau of Explosives, you will find that the most dangerous thing in interstate commerce is gasoline. Of course, the quantities moved have some bearing. The quantity moved is huge as compared with chlorine, and it always will be, but nevertheless the hazard of handling chlorine has not been great. Your man in the mill may be a little careless with his chlorine at first, but after he gets a whiff of it, I want to tell you that he will be a cautious gentleman.

This South Hadley Falls business, to my mind, was a beautiful illustration of the lack of forethought in installing safety devices. The chlorine was carried through a controlling apparatus, inside the mill, and there were certain safety devices to carry the gas outside when certain functions of the machine ceased. In this case they did cease, but the man who installed the equipment placed the outlet pipe just under the window of the rag room. When the forelady in charge of the rag room smelled the chlorine, she assumed it came from within the mill, which was a very proper thing to assume, and she opened the window, thereby permitting a larger volume of gas to enter.

There are large quantities of chlorine stored all over the country. There are 100,000 pounds of liquid chlorine in New York today in the congested district, and it has been there for years, and it is being used there. There are large quantities in the flour mills in this country, and the accidents haven't taken place. Now, these are in small containers. The larger containers have been in use since before the war, since 1914, when we got out tank cars. That is seven years, and the accidents have not taken place. Nevertheless, I think it is proper for us to consider that they may take place and to take every precaution to prevent accidents.

CHAIRMAN WILLIAMSON: We will now listen to the paper by Mr. Rosebush.

SOCIAL PHASES OF SAFETY WORK

F. H. ROSEBUSH, DEPARTMENT OF INDUSTRIAL RELATIONS, NEKOOSA-EDWARDS PAPER COMPANY, PORT EDWARDS, WIS.

No doubt many of you are wondering in what way any practical safety work can be done through social means. As my topic indicates, this social experiment I shall tell you about is only a phase of safety work. I offer it as a method of aiding safety work, for I realize that safety work to be permanent must be intensely practical and that it cannot be worked out at a moving picture show, a dance, or a community pageant. It must be inculcated in the daily program of the superintendents, foremen and men. Social means used may arouse interest in safety work when or where some other methods fail.

SAFETY DEPARTMENT IS ESSENTIAL

We have come to the conclusion that for safety work to be most effectively carried on, it must be done by a well organized safety department, just as the analytical work is done by a chemical department or the

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construction work by an electrical department. With this end in view, a safety department was organized in conjunction with an industrial and welfare department, which comprises safety, sanitation, first-aid, welfare work, hiring, transferring, and firing of men, wages, recreational activities, and problems relating to labor. This department was organized, and its plans and aims laid before the superintendents and foremen in exactly the same manner as the sales department, chemical department, electrical department, and production department.

Safety suggestions are made by the workmen's committee or by the safety inspector. These suggestions are sent to the superintendents, the foremen, and the head millwright after being carefully considered. The head millwright in each plant has in his organization an experienced safety man whose whole duty it is to look after the safeguarding work. The foreman's copy of the safety suggestion is sent him that he may know there is a place in his department where guard is needed, and he can make suggestions to the safety man in regard to the kind of guard to be constructed or other suggestions as to its location or adaptability. It is customary for the safety inspector to check up daily the safeguards and machinery in as many departments as possible throughout both mills.

The Nekoosa-Edwards Paper Company has adopted the usual standards of safety in its mills. Guards of wire and steel cover all gears, belts, pulleys, etc., in fact we have been told that the guarding in our mills is surpassed by none. I have gone into the organization somewhat in detail so that it could be understood what kind of an organization handled the social work in connection with safety.

There is in each mill an up-to-date first-aid room in charge of a registered nurse where not only mill cases are taken care of but also school children and members of workmen's families. The nurses in both plants find time to pay frequent visits to the schools, where in conjunction with the school doctors they give talks to the children on care of the teeth, personal cleanliness, and correct habits of study, recreation, and living. They also are members of the parent-teacher's association and are present at social functions, thus gaining the confidence of parents and children, which is so essential in their work.

MEETINGS FOR FOREMEN AND SUPERINTENDENTS

Each week on Tuesday at noon there is a dinner held for superintendents and heads of departments at which time mill questions are discussed. One of these meetings each month is devoted to discussion of safety work and safety problems. There is also held a combined foremen's and superintendents' meeting once a month which is in the nature of a banquet. These meetings alternate between the mills in Port Edwards and Nekoosa and all foremen not on duty are expected to attend. It is at these meetings that the ideas of the foremen are transmitted to the management and the questions are discussed and settled. The main idea of this monthly foremen's meeting was a safety meeting, but other matters pertaining to the foremen's work are also brought up and discussed here. Very frequently outside speakers are brought in at these meetings who talk on subjects interesting to the foremen.

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RECREATIONAL ACTIVITIES HELP TO REACH MEN

Each summer there has been a baseball team in each mill. Application for balls, bats, suits, etc., is made to the department of industrial relations. This fall football teams have been organized in the same manner. These activities are started by the employees and backed by the company through its department of industrial relations. But where, you may ask, do social phases of safety come in? My answer is that when we start a safety contest or get the men together for safety talks or go to them for safety suggestions, they feel that we are the same fellows who play ball with them, box and wrestle with them, go to dances with them, picnic with them, talk shop problems with them. In fact, we are of them, we are with them, and when we talk about safety we are talking to our crowd. They can understand us, and what is more they will listen and we get co-operation. One more vital thing. You can generally find the president of the company either quietly watching the social proceedings or tucked away in some corner giving an employee advice about how to insure his house, send his children to school, build an addition to his house or lending financial assistance. Do you wonder that we can talk safety?

A "NO-ACCIDENT" PICNIC

It is the aim of the employees' mutual benefit association not only to pay benefits but also to plan athletic games, picnics, and social functions participated in by employees. The big Nepco Picnic will be handled the coming year by the association. This picnic was planned as a big mid-year safety get-together meeting, at which there should be a demonstration of the first-aid work by doctors and nurses, and a big street parade with floats, safety banners, clowns, bands, and all other features which anyone could think of. Invitations were sent to safety engineers of other mills to be present and enjoy the day. The mills closed down, but all employees were paid regular time. It was to be an employees' safety picnic, and they were told to bring their families. They did. The mills employ about 1,000 men but we had 4,000 happy persons gathered ready to prove that they could demonstrate the safety idea by showing how a real safety booster could eat, play, swim, shoot and not get hurt, and they did it, too. Of all the hundreds of children who used the dozen swings among the trees, the participants of the trap shooting contents, the log rollers, the swimmers, the tug-of-war, pullers, the wrestlers, boxers, dancers, eaters, etc., not a single one had an accident during the day.

(This address was followed by motion pictures of the social and recreational activities described by Mr. Rosebush.)

DISCUSSION

MR. ROSEBUSH: In my paper I mentioned the Nekoosa swimming pool, and I might tell you how that swimming pool came to be built. The day after we held our picnic several boys were swimming in the river, and one of these boys was drowned. The question immediately arose why it would not be possible for them to have a swimming pool in town, where

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such accidents could not occur. In less than two months that pool was constructed.

I must tell you about one phase of the social safety work that was started last year just before Christmas. We decided to hold a contest between the Port Edwards and the Nekoosa Mills to see if at the end of the year we could have an active safety year in 1921, and so we proposed that the mills go into a contest. Among other things, the men were urged to hand in safety slogans. The mill that had the fewest accidents, handed in the most safety slogans, and helped in the safety work in various other ways which we indicated, was acknowledged the winner. For the best safety slogan which was handed in a gold watch was awarded as a prize.

We had to have a special committee to go over these safety slogans each morning, so that the totals could be put up on a big thermometer which we had at each mill. At the end of this safety week, we had a big dance in the auditorium. The seating capacity is eight hundred, and we had over a thousand people there, so you can well imagine that we had "some dance."

On August 1 we started a contest with the Kimberly-Clark mills, to see which could have the smallest number of accidents, and our accidents have been cut, due to that contest, about 90 per cent.

ADJOURNMENT.

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Public Safety Section

September 28-30, 1921

C. M. TALBERT, Chairman
St. Louis

DAVID VAN SCHAACK, Vice-Chairman
Aetna Life Insurance Company, Hartford, Conn.

C. B. PRITCHARD, Vice-Chairman
Director of Public Safety, Pittsburgh

CARL L. SMITH, Secretary
Central Mississippi Valley Division National Safety Council, St. Louis

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WEDNESDAY MORNING SESSION

IN the absence of Chairman Talbert, Secretary Smith presided.

REPORT OF SECRETARY

CARL L. SMITH, MANAGER, CENTRAL MISSISSIPPI VALLEY DIVISION, NATIONAL SAFETY COUNCIL

When this section was organized, the fundamental idea of the section was to use the secretaries and managers of local councils as the nucleus of the organization—in other words, in the past we found out we had appointed committee after committee, but no work was done during the year. So we appointed as the secretaries of committees in the Public Safety Section those men whose business it is to follow safety in their communities because they were paid for it, and because they are interested in it. Whether that scheme of organization shall be continued another year will be decided by the officers you elect at this session.

We are past the stage of experimenting. We know absolutely how to control public accidents in large cities. We know that with a certain amount of money spent and with a certain amount of effort put forth, we can get results.

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REDUCTIONS IN ACCIDENTAL DEATHS IN ST. LOUIS

In St. Louis we have this experience to report: In 1917 we had 510 deaths in the city. In 1920 we had 377. So far this year in all classifications, whether it be automobile, street car, falls in the home, children killed by poison or whatnot, we have had 32 fewer deaths than during the same period last year.

Our automobile fatalities are 18 fewer compared with the same period last year in the face of an increase of 20,000 machines on the streets of St. Louis. Our property damage has been decreased from $785,000 in 1918 to $598,000 in 1920, and the property damage will be further reduced this year.

The average monthly number of accidents for 1918 was 750; in 1919, 504; in 1920, 524, and this year they will be less.

St. Louis is not the only city in the United States that has done good work. Splendid work has been done in Cleveland, and fatalities reduced. Syracuse, Milwaukee, Rochester, Wilmington, Minneapolis and other cities have active local councils and are doing splendid work. Other cities where much good work is being done are Chicago, Los Angeles, San Francisco, Kansas City, Detroit, Louisville, and Cincinnati.

I would like to read the foreword of my annual report on the St. Louis Council to the National Safety Council, which touches on the public safety phase of accident prevention:

"While the value of safety education in industry has not been questioned from an economic standpoint, this has not been so in public safety. It has been found, in St. Louis at least, that the general public, while accepting the general theory of safety, has not yet fully assimilated safety education from a practical standpoint. With safety on a permanent basis in industry it has therefore been very desirable that the public safety work be put on the same substantial basis.

"Hence, the Central Mississippi Valley Division (or the St. Louis Safety Council) has been concentrating on this section and the results are crystallizing into definite action. Surveys made in St. Louis show that public opinion is thoroughly conscious of the fact that safety education is necessary, but the public has not yet grasped fully the comprehensive plan that is before the public safety section, that of serving the public both from an economic and humanitarian standpoint, as the industrial sections serve the industries. In other words, there are many who feel that the safety movement is a charitable matter, instead of a good business proposition based on economic facts and humanitarian judgment.

EDUCATING PUBLIC IN SAFETY

"So the public safety section of the Central Mississippi Valley Division has found, among other things, that in broadening public education in safety, the prime requisite is to show that the man who pays for safety gets his return with interest on his investment, and the surplus goes to the general public. In other words, the investor gets back his money with interest, while the whole community benefits in a larger way through accident prevention, life saving and much sorrow averted.

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"It is on this theory that the public safety section is now proceeding. Its viewpoint is that the larger the investment the individual makes, the greater interest he will get, and the greater the profit sharing will be for the entire community. The public safety section has first to interest itself through the statistical committee by carefully investigating accidents, as to cause, among other things whether the location has anything to do with the general accident situation.

"The method of financing the public safety section has been evolutionary. That is, education has become a business proposition which has to be financed, and now there is a realization that safety education must be taken out of the charity class and placed on a definite, business basis. That will take considerable education. Even some large contributors still feel that the safety movement is a charitable one. Not so, however, with the manufacturers who have worked out the industrial side. They see it as an investment with large returns because they were able to arrive at the cause of industrial accidents and then apply the remedy.

"In order to make public safety education effective in any community, it apparently has been demonstrated that all facts concerning causes of accidents must be first thoroughly analyzed and then the remedy, if possible, applied. Whether in the case of street cars, automobiles, trucks, homes or in school districts, the Mississippi Valley Division, as it is known locally, has just taken the first definite steps to put public safety on a permanent basis by launching plans for a constructive membership campaign and will do away almost entirely with contributions.

"This plan of membership, which is practically complete and which will be put into operation in the near future, will tie up the member, whether business man or individual, with the safety movement. There will be two classes of members, active and associate. The foremost among the active members will be public service corporations, associations, and large institutions, paying for their membership on a quota basis, established on the percentage of accident experience rate. This class of membership will also include clubs, societies and associations of various kinds, each of whom will appoint representatives to participate in safety affairs. This plan from its practical side will be selling safety on a dollars and cents basis."

(At this point Vice-Chairman Van Schaack took the chair.)

REPORTS FROM LOCAL COUNCIL CITIES

CHAIRMAN VAN SCHAACK: We will be very glad to hear from any gentleman who has anything to add to the secretary's report.

MR. R. C. HAVEN (Minneapolis Safety Council): So far as the reduction of accidents is concerned in Minneapolis, last year we reduced our coroner's inquests 17.1 per cent. We reduced the number from 146 to 121.

MR. C. M. ANDERSON (Safety Division, Milwaukee Association of Commerce): The Milwaukee Division of the National Safety Council was organized a year ago last July. For the year of 1919, there were 318 fatal accidents in Milwaukee. In 1920 there were 287, or a reduction of

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31. For the first six months this year we have a reduction of 28. We figure that we will have about 218 for 1921, which will mean that we will have made a reduction compared to 1919 of 100 fatal accidents, this in the face of a 35 per cent increase in motor vehicles on our streets.

MR. M. F. BRAMLEY (Cleveland Safety Council): We have reduced the number of accidental deaths in Cleveland 25 up to date this year. We have reduced the serious accidents 30 and the slight accidents 450. We have been operating really only three months.

CHAIRMAN VAN SCHAACK: It is very gratifying to hear these reports of progress. Of course, public safety work is in a formative stage as yet, but the experiments that are being tried out in various parts of the country are going to result finally in an effective method, I feel sure.

(A motion, accepting the report of the secretary, carried.)

NOMINATING COMMITTEE

The chairman appointed a nominating committee consisting of Mr. M. F. Bramley of Cleveland as chairman; Mr. Louis De Armand of Davenport, Iowa; Mr. Oliver Remmers of St. Louis; Mr. R. C. Haven of Minneapolis, and Mr. C. M. Anderson of Milwaukee.

CHAIRMAN VAN SCHAACK: The next order of proceeding is the report of the Committee on Public Accident Statistics, by Mr. Ryder of the National Workmen's Compensation Service Bureau of New York. Mr. Ryder is not here, but Mr. Cameron will present this report.

MR. W. H. CAMERON (National Workmen's Compensation Service Bureau, New York): I am not a member of the committee and had nothing to do with the preparation of the report, but your committee asked me if I would not present to you the following resolution:

IN MEMORIAM

FREDERICK S. CRUM

Died September 2, 1921, at Oakland, Maine

The death of Dr. Frederick S. Crum, Chairman of our Statistical Committee, brings to all his associates a fuller realization and deeper appreciation of his high endeavor and very real accomplishment. In his statistical investigations Dr. Crum was a true scientist. His constant researches into the cause and possible reduction of accidents and disease must help the coming generation to live longer and richer lives. Dr. Crum was a zealous and devoted worker. As an honored member of the staff of the Prudential Insurance Company he gave unsparingly of his time and strength to meet the responsibilities of his position and when his work brought national recognition Dr. Crum responded no less generously to the many outside activities which he has so ably served.

Be it therefore

RESOLVED, that we, as members of the Public Safety Section of the

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National Safety Congress, one of the many organizations to benefit through association with Frederick S. Crum, do hereby, at our Tenth Annual Congress, express deep regret for his untimely death.

BE IT FURTHER RESOLVED that this resolution be entered on our minutes, a copy forwarded to the Prudential Insurance Company and another to the bereaved family.

(The resolution was adopted.)

MR. CAMERON: The report of the committee is as follows:

REPORT OF COMMITTEE ON PUBLIC ACCIDENT STATISTICS

The relatively great importance of public accidents as a factor in accident mortality has been signally demonstrated by statistics from several sources. An analysis of fatalities through accident in the United States for a single week ending August 28, 1920, shows that of 1,208 accidental deaths, no fewer than 758, or 62.7 per cent were caused by *public* accidents; 359, or 29.7 per cent, were the result of *industrial* accidents; and the remaining 91, or 7.6 per cent were the result of *home* accidents. (These data were gathered by the National Safety Council with the cooperation of 200 city and county coroners, the secretaries of 35 local safety councils, and 8,000 representatives of the National Safety Council's member companies.) Second; out of 20,045 accident claims paid by the Travelers Insurance Company during the year 1920, only 3,126, or 15.6 per cent were classified as home accidents; 7,572, or 37.8 per cent, were included in the occupational group; and the remainder, 9,347, or 46.6 per cent, were public accidents of one kind or another. A summary of 91,896 claims paid over the five year period, 1916-1920, shows about the same percentage distribution. Third; a consideration of the causes of accidental deaths for the entire United States for 1919, shows that the leading causes were falls, automobiles, burns, railroads and drowning. Of these, burns result largely from home accidents; falls are probably more equally divided among public, home and industrial accidents; but the three remaining causes—automobiles, railroads and drowning—are almost entirely public accidents. These facts are sufficient evidence of the enormous amount of intensive safety work that is still to be done in the field of public accidents.

There were approximately 75,500 fatal accidents in the continental United States during 1919, of which number 55,500 were males and 20,000 females. This estimate is made from the U. S. Census Bureau's statistics for the registration area, which comprises over 80 per cent of the population of the entire country. Following is a distribution of these accidents by the more important causes:

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FATALITIES IN THE CONTINENTAL U. S. DURING 1919

	Males		Females	
	Number	Rate per 100,000	Number	Rate per 100,000
Automobiles	7,372	13.77	2,453	4.77
Railroads	6,878	12.85	895	1.74
Falls	6,503	12.15	5,370	10.44
Drownings	6,302	11.78	916	1.78
Burns (exclusive of conflagrations)	3,314	6.19	4,588	8.92
Mines	2,686	5.02	1	—
Firearms	2,483	4.64	414	0.81
Machines	2,446	4.57	121	0.23
Deleterious gases	2,417	4.52	1,139	2.21
Other vehicles	2,145	4.01	284	0.55
Street cars	1,875	3.50	487	0.95
Other acute poisoning	1,359	2.54	821	1.60
All other causes	9,640	18.00	2,636	5.12
Total	55,420	103.54	20,125	39.12
Total, 1914	58,701	117.24	18,338	38.10

Combining the male and female deaths shows the principal causes arrayed as follows:

FATAL DEATHS IN U. S.—1919—MALE AND FEMALE COMBINED

Cause	Number	Rate per 100,000 population
Falls	11,873	11.31
Automobiles	9,825	9.36
Burns (not conflagrations)	7,902	7.53
Railroads	7,773	7.40
Drownings	7,218	6.88

An analysis of fatal accidents in the United States for the one week ending August 28, 1920, shows that the following were the more important causes of death:

CAUSES OF FATALITIES IN THE UNITED STATES FOR WEEK ENDING AUGUST 28, 1920

	Males	Females	Sex not stated	Total
Automobiles	239	74	....	313
Steam railway	219	33	....	252
Drownings	127	20	4	151
Falls	85	17	1	103
Street railway	41	9	....	50
Mines	39	.....	....	39
Gun-shot	36	3	....	39
Burns and scalds	13	20	....	33
All other causes	206	22	....	228
Total	1,005	198	5	1,208

The relative importance of some of these causes varies with the seasons and their order of supremacy is not typical of the entire year. For example, for the whole years 1919, falls were first, automobiles second and burns third; for the week ending August 28, 1920, falls were fourth, automobiles first, and burns as far down as eighth.

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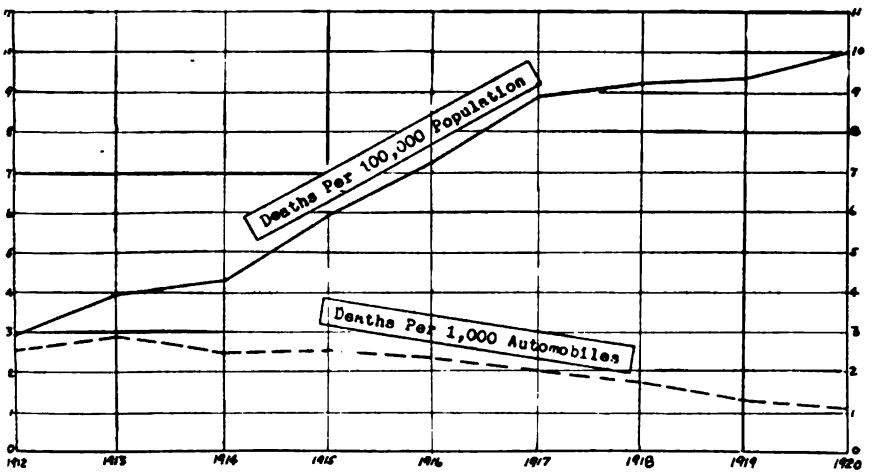
AUTOMOBILE AND OTHER TRAFFIC FATALITIES

Pre-eminent among the preventable causes of death stands the automobile. In 1915 there were 2,445,664 automobiles registered in the United States which caused approximately 5,900 fatalities. In 1920, with 9,211,295 automobiles in use, the number of deaths mounted to about 10,640. These figures exclude the fatalities which occurred as the result of collisions of automobiles with heavier vehicles such as railway engines and street cars. Such fatalities represent about 7 per cent of all other automobile fatalities, so a complete estimate of the automobile deaths in the United



DEATHS FROM AUTOMOBILE ACCIDENTS IN THE REGISTRATION AREA, 1912-1920

States for the last year reaches the alarming figure of 11,358. The attached curve shows the trend in the automobile death rate since 1912.

These estimates for 1920 are made possible by statistics on automobile fatalities for sixty-two cities of the United States which are summarized in the following table. The assumption was made that the percentage of increase (1920 over 1919) shown for the sixty-two cities was approximately the same as the rest of the country.

AUTOMOBILE FATALITIES IN 62 CITIES OF THE U. S.

(*Rates per million population*)

Year	Population	Fatalities Number	Fatalities Rates
1915	23,317,162	1,831	78.5
1916	23,982,727	2,321	96.8
1917	24,508,032	3.044	124.2
1918	25,033,352	3,444	137.6
1919	25,560,244	3,561	139.3
1920	26,086,355	3,880	148.7

It is significant to note that while the automobile death rate has greatly

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increased during the last six years, the fatality rate from other types of vehicles has steadily declined. The following table shows the facts:

HIGHWAY VEHICULAR FATALITIES IN 35 CITIES OF THE U. S., 1915-1920

(*Rates per million population*)

Year	Population	Automobile Number	Automobile Rate	Street Car Number	Street Car Rate	Railway Number	Railway Rate
1915	15,860,800	1,274	80.3	559	35.2	860	54.2
1916	16,206,450	1,565	96.6	668	41.2	1,057	65.2
1917	16,551,899	2,057	124.3	785	47.4	1,078	65.1
1918	16,897,362	2,330	137.9	787	46.6	1,014	60.0
1919	17,244,398	2,468	143.1	576	33.4	723	41.9
1920	17,591,038	2,670	151.8	525	29.8	714	40.6

Year	Other Vehicles* Number	Other Vehicles* Rate	All Vehicles Number	All Vehicles Rate
1915	403	25.4	3,096	195.2
1916	497	30.7	3,787	233.7
1917	388	23.4	4,308	260.3
1918	359	21.2	4,490	265.7
1919	265	15.4	4,032	233.8
1920	214	12.2	4,123	234.4

*Mostly horse-drawn, but including bicycles, motorcycles, and airplanes.

During this six-year period the automobile fatality rate in these 35 cities increased 89.0 per cent while street car fatalities showed a decrease of 15.3 per cent, railway fatalities a decrease of 25.1 per cent, and "other vehicles" a decrease of 52.0 per cent.

The following table goes into more detail concerning the type of vehicle involved in traffic accidents:

HIGHWAY VEHICULAR FATALITIES IN 52 CITIES OF THE U. S. DURING THE CALENDAR YEAR 1920

(*Rates per million population*)

Population 13,269,773

Kind of Vehicle	Number	Rate	Per cent of "All Vehicles" Rate
Automobile	2,070	156.00	58.6%
Street car	509	38.4	14.4
Railway engines and trains	747	56.3	21.2
Motorcycles	71	5.4	2.0
Bicycles	12	0.9	0.3
Horse-drawn vehicles	104	7.8	3.0
All other vehicles	18	1.4	0.5
All vehicles	3,531	266.2	100.0

The National Workmen's Compensation Service Bureau has made an interesting analysis of collision accidents sustained by automobiles insured against damage to themselves. Collision between two vehicles caused most of the accidents.

Car collided with	Number of Accidents	Per cent
Road-bed	153	2
Curbing	282	4

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Ditch or embankment	178	2
Building (on entering or leaving same)	555	7
Another vehicle	4,580	60
Any other object	1,879	24
Upsets without prior collision	26	0.6
Unknown	12	0.4
Total	7,665	100.0%

While on the subject of automobile accidents, it should be stated that the variation of motor vehicle laws between states and even more so, between municipalities, is confusing and often dangerous to pedestrian and motorist alike. For example, the minimum age for drivers for 37 states of the Union varies from 14 to 18 years, while in the remaining 12 states there is no minimum age requirement. Some states examine all applicants for driving licenses, but other states do not even require motorists to obtain licenses.

Nearly all state laws make provision for the suspension and revocation of licenses for just causes, but many states are lax in enforcing that portion of the law. In contrast is the excellent work of the Massachusetts Examining and Investigation Department which, during 1919, suspended 1,013 licenses and revoked 856. There must be closer co-operation between police departments and motor vehicle commissions so that traffic laws may be rigidly enforced and the violators thereof adequately punished.

FALLS

There were approximately 11,900 deaths from falls in the United States in 1919; 6,500, or 54.6 per cent being males, and 5,400, or 45.4 per cent being females. An analysis of 5,928 personal falls made by the Oregon State Industrial Commission for the period 1916-1919 shows the six leading causes to be:

	Per cent.
Slipping, stumbling, tripping	33.4
Scaffolds, stagings	15.8
Poles, trees	6.5
Runways, platforms, etc.	5.4
Ladders	5.2
Floor openings	5.2

The ordinary mortality experience of the Prudential Insurance Company for 1916-1920 showed 516 deaths due to falls, of which number 249, or 48.3 per cent, are classified as home accidents; 124, or 24.0 per cent, as public accidents; 59, or 11.4 per cent, as industrial accidents, and 84, or 16.3 per cent are not specified. A summary of the Prudential's industrial mortality experience for the period July 1st to December 31, 1920, shows 572 fatal falls distributed as follows: home 194, or 33.9 per cent; public, 85, or 14.9 per cent; industrial, 134, or 23.4 per cent; not specified 159, or 27.8 per cent.

DROWNINGS

Drowning causes a comparatively greater number of deaths among males than among females. Of the 7,218 fatalities in 1919, 6,302, or 87.3

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per cent were males and 916, or 12.7 per cent were females. The following table shows the trend of drowning accidents for the five year period 1915-1919:

DEATHS FROM DROWNING IN THE U. S.

(*Estimated from U. S. Census Reports on the Registration Area*)

Year	Males	Females	Total
1915	8,117	1,533	9,650
1916	7,795	941	8.736
1917	6,612	830	7,442
1918	6,006	945	6,951
1919	6,302	916	7,218

The number of deaths due to drowning varies, of course, with the seasons. Drowning ranked fifth among the causes of death during the entire year 1919, but was third in importance during the week ending August 28, 1921.

RAILROAD ACCIDENTS

Some interesting information on railroad accidents may be gleaned from the Accident Bulletin of the Interstate Commerce Commission. From the following table it appears that of the total number of persons killed only about 4 per cent were passengers whereas over 34 per cent were employees:

RAILROAD ACCIDENTS IN THE U. S.

Year	Total Number of Accidents	Passengers Killed	All Employees Killed	Other Persons Killed	Total Casualties
1917	210,729	301	3,348	6,438	10,087
1918	194,553	471	3,493	5,322	9,286
1919	169,848	310	2,454	4,716	7,480

About one-fifth of all the above casualties were due to nighway grade crossing accidents as follows:

HIGHWAY GRADE CROSSING ACCIDENTS IN THE U. S.—PERSONS KILLED

Year	Number of Acidents	Total Casualties	Trains striking or being struck by— Pedestrians	Automobiles and Trucks	Trolley Cars	Other Vehicles	Miscellaneous
1917	4,071	1,969	534	1,083	17	335	—
1918	3,849	1,852	452	1,131	28	241	—
1919	3,859	1,784	375	1,232	7	168	2

ELEVATORS

A summary of the elevator accidents in the United States reported by the public press for the period January, 1913, to July, 1918, shows 978 fatalities and 1,386 non-fatalities, distributed as follows:

	Fatalities		Non-Fatalities	
	Number	Per cent	Number	Per cent
Public	407	41.6	569	41.1
Semi-public	36	3.7	27	1.9
Industrial	528	54.0	779	56.2
Not otherwise classified	7	0.7	11	0.8
Total	978	100.0	1,386	100.0

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This table clearly shows the importance of the elevator as a cause of public accidents. The ordinary mortality experience for the Prudential Insurance Company shows a total of 28 deaths by elevators for the period 1916-1920. Of these, 14 are classified as public accidents, 12 as industrial, 1 home, and 1 not specified.

The following table shows the public elevator accidents distributed by cause:

	Fatal		Non-Fatal	
	Number	Per cent	Number	Per cent
Fell into shaft from landing floor, or due to motion of the car	150	36.85	121	21.3
Crushed between car and sill of landing floor or frame of door	150	36.85	107	18.8
Accident occurred inside shaft	96	23.60	330	58.0
Not otherwise classified	11	2.70	11	1.9
Total	407	100.00	569	100.00

Experience compiled by the Industrial Commission of Wisconsin shows the following for the period January, 1915, to July 1, 1920:

	Fatal	Non-Fatal
Falls into shaft from floor or from car	8	77
Crushed between platform and car, or between platform and gate, or between side and gate	7	149
Accidents occurring in shaft	5	142
Not otherwise classified	6	83
Total	26	451

These facts point out that a large proportion of the fatalities occur at the *shaft door*, and that comparatively few can be attributed to broken cables, falling cars, hoisting machinery, and so on.

AIRPLANES

Data compiled from newspaper clippings of aircraft accidents for the year 1920, show a total of 49 accidents involving 59 deaths and 29 injured. Of those killed, 35 were pilots and 24 passengers. For the first six months of 1921 40 accidents were reported with 14 fatalities and 52 injuries. An analysis of the 40 accidents occurring in 1921 shows that 17 of the number were due to poor piloting, and that 10 were due to poor fields or the lack of proper landing places.

The rapidly increasing popularity of the airplane promises a new menace to the public. This has been demonstrated time and again, as for example when a navy seaplane side-slipped to the beach at Pensacola, Fla., on March 2, 1921, and killed five bathers.

ACCIDENT REPORT FORMS

It will be recalled that this Committee devoted considerable space last year to a discussion of public accident report forms. A set of forms was

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drawn up and submitted to a special committee of the National Safety Council. This special committee adopted the forms with the recommendation "that they be printed and distributed among cities in the United States with a population of 25,000 or more, so that the proposed standard method of reporting accidents might be put into effect in all of these cities not later than January 1, 1921, if possible."

It was recognized then, as it is today, that intelligent safety work cannot proceed without a complete knowledge of the facts of the case. This implies adequate and reliable statistics on the hazards involved, their causes and effects. It was further realized that, as conditions exist today, it is practically impossible to combine on a common basis statistics for different localities and for different periods of time; that it is impossible to get a sufficiently large number of accidents analyzed in sufficient detail to enable one to draw proper conclusions. The public accident report forms prepared by this committee may not be correct in all details, but they nevertheless solve the problem by providing a standard method and medium of accident reporting.

Your committee observes with regret that its forms were not introduced as planned. Of course, much preliminary work had to be done before the forms could be presented for adoption to the various city police departments. Copies were sent to the managers of the local councils so that they might discuss them personally with the heads of the police departments. Much valuable criticism was received, and several improvements were made in the blanks as a result of suggestions made by the police commissioners themselves.

The inability of the National Safety Council to promptly print these forms made the effort to secure their adoption less effectual. For example, the authorities of St. Paul, Minn., were strongly in favor of using the reports and only the fact that they were not printed stood in the way of their adoption early last spring. The claim department of Buffalo has recommended that the forms be used in that city, and the police department of Louisville, Ky., has agreed to adopt the forms either this month or next.

In order to make these forms readily available, the Prudential Insurance Company of America has volunteered to make the necessary electroplates at a very moderate cost. If ten cities could be interested in having the blanks printed, a complete set of plates could be furnishd at a cost of about $80 per city.

It is earnestly recommended that a strenuous effort be made to introduce these forms in the next few months, to the end that many cities in the country may begin reporting their 1922 public accident data in a useful and uniform way.

FOR THE COMMITTEE:

A. RYDER,
H. P. STELLWAGEN,

(A motion to adopt the foregoing report was carried.)

CHAIRMAN VAN SCHAACK: Dr. E. George Payne will present the report of the Committee on School Hazards.

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REPORT OF COMMITTEE ON SCHOOL HAZARDS

DR. E. GEORGE PAYNE, PRINCIPAL, HARRIS TEACHERS' COLLEGE, ST. LOUIS

I am not going to attempt to give you a statistical report of the work on school hazards and the work in the schools. There are, however, two points that I wanted to emphasize before this body. I think there has been sufficient evidence presented in other meetings of the Safety Congress and particularly in a conference yesterday morning, to indicate what can be done by instruction in the schools, because I am sure no one who was there and heard those reports from the various cities could help being deeply impressed with the influence of school instruction in the reduction of accidents.

The point that I wanted to make first was simply this: The work of school safety education is not a separate activity, but is a part of the whole accident prevention movement. I have come definitely to the conclusion that the school people, to put this job over, need the assistance of those who are in immediate contact with the accident situation. In the first place, the teaching profession has had to be made conscious of the importance of accident prevention by the business interests, by the industrial interests and by the local safety councils. That is obviously true and necessary, it seems to me, because teachers inherit a conventional program, a conventional curriculum and it is very hard for them to break away from it.

It is the problem of the local safety councils and the National Safety Council and the men in the industrial field to bring data of the kind presented in the statistical report here today to the teaching profession so that they can work it into the life and character of the children with whom they deal. So it is really a problem of co-operation and you must do the co-operating by making the teachers feel that you can bring something to them that will be worth while.

There is one other point. The problem of education in accident prevention is a fundamental part of education. You cannot do it in one subject; you cannot do it through lectures; you cannot do it through any of the artificial methods. If you attempt to do this work through one subject, it becomes a monotonous sort of thing. It must be a part of every subject of instruction and that is the thing that should be kept in mind.

(A motion accepting the report carried.)

DISCUSSION

MISS LAURA ROADIFER (Philadelphia Rapid Transit Company, Philadelphia): I would just like to emphasize what Dr. Payne has already said and supplement that last point that he made, when he said that this safety education in the schools should be directed by the people in charge. Let me say to you men, some of whom have gone into the schools on this safety proposition, that it has been recognized in Philadelphia as a valuable aid to have an outsider come in and present a subject of

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this kind. Very often a new voice, a new personality will make a deeper impression in a subject which is fundamentally unattractive than if it were presented exclusively by the teachers.

MR. J. H. WYSE (Ontario Safety League, Toronto, Canada): We found the same thing in Toronto. An outsider coming in and talking to the children gave it a great deal more impetus than if the teachers themselves talked. In our essay prizes we found the same thing. We found it advisable to have the prizes presented by an outsider and as much publicity given to the matter as possible.

MR. C. W. PRICE (National Safety Council, Chicago): I want to add just a word to the point that Dr. Payne emphasized regarding the importance of co-operation between the schools and the industries. It has been my privilege during the last year or two to be present at the first contact made between the schools and the local council, and there is nothing that so immediately gets results and stimulates the school people as to find out that the industrial managers are vitally interested in school safety.

MR. H. VAN Y. CALDWELL (Cleveland Safety Council): There are certain principles which we have attempted to lay down in the plan of safety education in Cleveland. First of all it was felt that there must be an organization to carry this on, that in each school there must be some definite person responsible for the continuous performance of the safety course in that school, that in the school headquarters there must be some one who would be definitely responsible for the material furnished to these supervisory principals or others in the schools, and that that person must be in close contact with the local safety council.

Second, it was felt that the class-room instruction should be supplemented by school organization work; for this reason if no other, that the school organization work is the best way apparently that we have found in the other cities to reach the home. Your class-room instruction does not reach the homes, but with 20,000 children in a large city going home continually with a safety button on their coats, or continually bringing reports to the homes, or engaging in safety activities, investigations around the home and in the neighborhood, it brings the parent closely in contact with the movement.

MR. C. G. RICE (Western Pennsylvania Division, National Safety Council, Pittsburgh): I am one of those who believe that the safety instruction in the school is the most fundamental thing that can be done in connection with safety. My experience proves that, and I also believe that your children and mine will be profiting from the experience in years to come. Industry takes it as a real part of its work and recognizes it as a desirable activity even at its own expense.

I want to make this point: My experience has been that wherever anyone presented the facts to the school authorities, they were not only willing but anxious to do something in connection with the work.

The report of the statistical committee struck me as exactly the kind of data that the school authorities would like to get. I move that it be printed and made available immediately, because the quicker it gets

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into the hands of the school authorities the quicker the work is going to go on.

(The motion carried.)

HOW SCHOOL SAFETY WAS FLOATED IN CINCINNATI

MR. MCCLAIN (Louisville Safety Council, Louisville, Ky): In our contact with the schools in Cincinnati we did a bit of work of which we were proud. I went to the superintendent of education, and said, "Dr. Condon, it is rapidly being developed that one of the greatest bits of school work that can be done is to organize for accident prevention." He said, "I agree with you; what have you to suggest?" I said, "I represent the local safety council. I have at my command the information and the figures and other things that will be of vast assistance. I suggest to you that you appoint a live, up-to-date principal to work with me, and he and I will draft a plan subject to your approval." He agreed.

We went to it. First, we said, "This must touch every school. We recommend that the superintendent of education appoint some teacher in each district in the city to sit on and be a member of the school safety council, with this principal presiding."

That was done; we called those teachers together. We submitted a plan to immediately form an organization among the children known as the Cincinnati Safety Guards. We came to the conclusion that the word "guard" was the proper word to use for this reason—life guard, safety guard! We are guards of ourselves, our friends, our families, our homes, everywhere we go. It appealed to them. There was a very definite pledge. "I will be responsible for my own safety and the safety of others." The guards learned that pledge by heart. There were twenty-three rules of operation covering the average things that a boy or girl contend with, covering their home conditions, fire conditions, street conditions, falling wires, school conditions, etc. They took that on very rapidly. The teachers said, "We are for it; how are we going forward?" I said, "I will go to the newspapers and I will get them to print a little column each day and we will call it the 'Safety Corner,' and you can use it as a topic for your discussion that day."

GETTING CO-OPERATION OF NEWSPAPERS

We did that and the newspapers immediately fell for it. I went to one of them and said, "I have here a scheme that will give you an advantage over the other fellow. I will furnish you the copy every day for a Safety Corner of 100 words, and the boys will come home and say, 'Pa, we have got to take the *Post* because it has the safety lesson in it.'"

The editor said, "You're on." So I furnished him the material and he printed it.

Then the other paper came to me and said, "Where are we going to get off?" I said, "How would you like to have a Safety Question Box in your paper? I will write the questions and I will answer them."

So one paper carried the Safety Corner and the other the Safety Ques-

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tion Box, and we furnished the material to the teachers and the teachers and the children clipped it and they prepared scrap books that they could paste it in.

The organization was a success and the teachers worked night and day on it. The boys and girls have their own courts. For instance, a boy who is caught hopping a truck. They bring him in before this court and say, "You, a safety guard, a man who has taken a pledge, have been found guilty of violating this sacred pledge; you hopped on a truck." He is brought to realize the very tremendous importance of this violation of one of the first principles of safety. In many cases the children pass judgment, and recommend to the teacher that a violator be detained in his room fifteen minutes each day for one month.

In four months' time we had 12,300 Safety Guards and we paraded them in the city of Cincinnati, with the judges and the school officials and the chief of police, and the school band.

CHAIRMAN VAN SCHAACK: We will have the report of the Committee on Elevator Hazards. Mr. Elzy is not here and I understand that Mr. Fox has his report and will present it.

MR. FRED F. FOX (Aetna Life Insurance Company): I am not a member of your Committee on Elevator Hazards and have had no part in the preparation of this report.

REPORT OF COMMITTEE ON ELEVATOR HAZARDS

E. P. ELZY, AETNA LIFE INSURANCE COMPANY, HARTFORD, CONN.

The actual relative importance of various elevator hazards can only be determined by a careful study of elevator accident statistics to learn the frequency with which accidents have occurred from different causes and the seriousness of the resulting injuries. Such a study on a country-wide scale is impossible at the present time for the simple reason that there are no such statistics. In some states, elevator accident statistics are not compiled at all, and there is such a lack of uniformity of records in others that accurate comparisons and deductions are impossible. Your committee, therefore, recommends that the National Safety Council prepare a form to be used for reporting elevator accidents and that it should attempt to secure the adoption and use of the form by all states and municipalities.

Notwithstanding the meagerness of statistical data on elevator accidents, it is possible to draw certain broad and general conclusions from those in existence. Elevator accidents may be roughly divided into three groups or classes, as follows:

1. Those due to faulty construction and installation.
2. Those due to improper maintenance and repair.
3. Those due to careless operation.

Accidents due to faulty construction and installation should never occur, and are entirely preventable. A permit should never be granted for the installation of an elevator until complete plans and specifications have been submitted to the proper city official and studied by him to

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determine if due consideration has been given to safety, with regard both to the strength of materials used and to the proposed manner of installation. As soon as each installation is completed, a careful inspection of it should be made to learn if the specifications have been followed and if the mechanism is all in proper working order. Then, and only then, should the operation of the elevator be permitted. If the installation is not up to standard, or if any of the mechanism is not in proper working order, the operation of the elevator should be strictly prohibited until the necessary changes have been made.

The remedy for accidents due to improper maintenance and repair is periodical inspection by competent persons whose recommendations should have the support and backing of the law. A study of the elevator inspection report forms used in the principal cities of the country would indicate that in some instances at least the inspections made by city inspectors are of a most perfunctory nature. We are dealing with one of the most important phases of public safety, and it is but little short of criminal negligence not to require the most careful attention to essential details on the part of inspectors who are charged with the duty of discovering conditions likely to cause accidents as well as to detect violations of the law. Your committee on elevator hazards urges the use of a uniform report by all municipal elevator inspection departments—a report so worded that the inspector will be required to commit himself definitely regarding the condition of all parts of an elevator which have any bearing on its safe operation. This suggestion is made not because of any doubt as to the integrity of the average inspector, but to focus attention upon a laxity in reporting hazardous conditions and a corresponding laxity on the part of officials immediately responsible for the safeguarding of human lives.

One of the most prolific causes of elevator accidents is careless operation. Even though an elevator is properly constructed and installed, and kept in a good state of repair, accidents will occur if carelessness in operation is tolerated. Because the safety of the elevator using public depends so largely upon this factor, your committee deems it advisable to suggest that all elevator operators be given a course of instruction in safety as applied to elevator operation and that operating rules be placed in each elevator.

The National Safety Council has published an excellent set of operating rules in Bulletin 922. A few changes and additions have been suggested, and, thus revised, the rules will read as follows:

RULES FOR ELEVATOR OPERATORS

You cannot operate an elevator safely and do something else at the same time.

1. Make sure the landing doors are closed and latched, and that everybody is in a safe position before you start the elevator.
2. Always remember the safe capacity of your car, and never allow it to be overloaded.
3. Bring the elevator to a full stop before you attempt to reverse its direction.
4. Be sure to place the control in its neutral position and wait until the elevator stops before you open the doors or gates.
5. If the elevator does not operate properly, do not attempt to run it, but notify your superior at once.

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6. If the safety device should operate and stop the elevator, place the control in neutral position and send for your superior; if the elevator should stop between floors, keep cool and do not allow anyone to leave the car, and in any case do not allow anyone to leave the car unless the control is in neutral position.
7. Do not allow unauthorized persons to operate the elevator.
8. Never leave the elevator unattended unless the car is empty and the doors or gates are closed and latched.
9. Be careful to stop the elevator with the car floor level with the landing floor. If you have failed to do so, give warning by saying, "Step up, please," or "Step down, please," as the case may be. Never attempt to correct a bad stop by moving the elevator when the door is open.
10. Operators must not converse with the passengers or allow fooling, scuffling, or horse-play on the elevator.
11. Require the passengers to face the door. When stopped at a landing, do not allow passengers to enter the car until all have left it who desire to do so.
12. Always stop the elevator at the terminals (top and bottom landings) with the operating device, and do not depend on the automatic stop.
13. Always call out the landing when making a stop, so that anyone in the back of the car may know at what floor the elevator is stopped.
14. Make a trial inspection trip each morning before carrying passengers.
15. Carry no passengers while inspections, repairs or adjustments are being made, and operate the elevator only in response to directions from the inspector or person in charge.

Learn these rules thoroughly and keep a copy in the car. Always remember that your life, and the lives of others, are dependent upon your alertness, caution and good judgment.

ELEVATOR INSPECTION REPORT FORM

Division of Elevator Inspection. Inspection Report

CITY OF.....

BUREAU OF SAFETY ENGINEERING

John Doe, Chief Inspector

(Use one report for each elevator)

Name of inspector.....

Location of building.....

Date of Inspection.....

Type of elevator .....

Freight .....

Passenger .....

Combination .....

Elevator number .....

Owner or lessee of building.....

Building occupied by .....

Persons responsible for care and operation of elevator.....

Is operator competent .....

Capacity in lbs. or number of persons.....

GIVE CONDITION OF:

Landing doors or gates	Brake .....
Interlocks	Slack cable device.....
Hoist cables	Safety device .....
Drum counterweight cables.....	Automatic limit stops.....
Car counterweight cables.....	Belts and pulleys .....
Operating cable or switch.....	Hoistway and car enclosure.....
Governor cable	Engine, pump, or motor.....
Machine	

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FOR HYDRAULIC ELEVATORS ONLY:

Condition of operating valves.....

Condition of piston rods and traveling sheave frames.....

When were piston rods last examined.....

Pressure carried .....

Safety valve is set to blow at what pressure.....

REMARKS: State specifically below any section of ordinance violated, and any recommendation you may have to offer.

.....

.....

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A LESSON IN SAFETY FOR ELEVATOR OPERATORS

GENERAL

There are two essential qualifications which an elevator operator must possess before he can be called an expert in his line of work. The first is ability to operate an elevator efficiently and economically for his employer; the second, the ability to operate it in such a manner that accidents will never occur. The second qualification is no less important than the first, and every operator who hopes to become expert in his line of work must learn to perform his duties safely if he wishes to make himself of increasing value to his employer. As a matter of fact, careful elevator operators are also the most efficient ones.

To operate any kind of machinery intelligently, it is necessary for one to acquire a general knowledge of its construction. Elevator operators should familiarize themselves as much as possible with the mechanical and electrical parts of elevators, so as to be able to detect conditions which would tend to make the elevators unsafe to operate. This is especially true regarding the parts which are provided primarily to prevent accidents. This lesson is written to assist operators in the acquisition of this necessary knowledge.

AUTOMATIC LIMIT STOPS

Limit stops are very important devices. If anything should happen to the controlling device while the car is ascending or descending, the automatic limit stops will shut off the power when the car has reached a pre-determined point of travel above the top landing or below the lower landing. This is important because, should the machine continue to run, the car or the counterweights would be pulled up against the overhead beams, in which case the cables would be likely to break and result in considerable damage being done.

The automatic limit stops are inspected whenever an inspection of an elevator is made, and they will usually remain in adjustment between inspections if they are not abused. Operators should always use the regular controling device to stop the car at the uppermost and lowest landings, and never depend upon the limit stops to shut off the power, as continued use of the stops for this purpose causes them to wear, and if persisted in may render them unserviceable when most needed to prevent damage to the elevator and injury to the passengers.

CAR SAFETY DEVICE

All modern elevators are provided with a device which will prevent the car from falling if the cables should break or the car should attain an excessive speed from any cause on its downward travel. Though there are several kinds of car safeties, the general principle on which all of them work is the same. The parting of the cables or the travel of the car downward at an excessive speed causes the device to grip the guide rails and bring the car to a stop. Should the safety device operate and stop the car, the operator should place the con-

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trol in the neutral position and send or signal for his superior. At such a time, an operator will have an opportunity to display calmness and good judgment by assuring the passengers that they are in no danger and allowing no one to attempt to leave the car until the authorized person in charge considers it safe to do so.

LANDING DOORS

Many elevators are provided with electrical contacts or interlocking devices which make it impossible to operate the elevators until the landing doors are securely closed and locked. These devices often prevent the operator from opening the doors unless the car floor is within two or three inches of the landing floor level. The operator should never move the control out of the neutral position until the doors have been closed.

There are still a large number of elevators not equipped with electrical contacts or interlocking devices. With such installations it is possible to open the landing doors at any time and to start the car regardless of whether the doors are closed or open. This is an exceedingly dangerous condition as the available statistics show that a very large percentage of elevator accidents occur at the landing doors and that many of these are due to persons attempting to leave or enter the car while it is in motion. Great responsibility rests on the operators of elevators not provided with interlocking devices. They should always see that the landing doors are shut and locked on the inside before starting the elevator away from a landing. They should promptly notify their superior of any defects which they discover in the working of the doors.

CAR DOORS AND GATES

When an elevator is equipped with car doors or gates, the operator should always see that they are closed before starting the elevator. If the car is not provided with doors or gates, the operator should extend his arm across the car opening to prevent the passengers from getting caught on the inside of the landing doors as the car passes them. He should always make a practice of requesting the passengers to stand back from the entrance, and if there is any crowding toward the front of the car, he should bring it to a stop and insist that the passengers step back.

EMERGENCY BRAKE

An emergency brake is a device by means of which the operator can bring the car to a stop. This is accomplished by turning the wheel or pulling the lever in the car which sets the car safety, and, as its name implies, it is for emergency use only. The emergency brake should never be employed to stop the car unless the car attains an excessive speed on its downward travel from some cause and the safety device fails to work in the ordinary manner and the car cannot be stopped by placing the control in the neutral position. It requires presence of mind and quick action to set the safeties by means of the emergency brake. Consequently, every operator should become thoroughly familiar with the location of the device and the manner in which it is used.

CONTROLLING DEVICE

Never place the controlling device in the reverse position without first bringing the elevator to a complete stop. Always place the control in its neutral position before the power is turned on the machine.

DISCUSSION

CHAIRMAN VAN SCHAACK: I would like to remind those present that it has been the idea of this section that the report of the Committee on Elevator Hazards might form a basis for lessons to be prepared and

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distributed to elevator operators in the different cities in which the Council is interested.

(A motion was made and seconded that the report be accepted.)

SECRETARY SMITH: I would like to incorporate in that an amendment to have this inspection form printed and distributed to the various local councils so they may send that to the director of public safety in their particular municipalities.

(The amendment was accepted. The motion as amended carried.)

ELECTION OF OFFICERS

MR. BRAMLEY: The nominating committee reports as follows:

David Van Schaack, Chairman.

C. W. Price and L. G. De Armand, Vice-Chairmen.

Carl L. Smith, Secretary.

(The report of the nominating committee was accepted unanimously.)

CHAIRMAN VAN SCHAACK: I am very appreciative of the honor and compliment that you have paid me.

ADJOURNMENT.

THURSDAY MORNING SESSION

CHAIRMAN PRICE: Mr. Van Schaack has asked me to preside this morning. The secretary will read a report on the Boy Scouts by Mr. J. P. Freeman, Assistant National Field Secretary.

REPORT OF THE BOY SCOUTS OF AMERICA TO THE NATIONAL SAFETY COUNCIL

The Boy Scouts of America both as an organization and through its individual members now numbering half a million boys and men is continuing its earnest efforts in behalf of public education in safety, fire and disease prevention, public and private health. In practically every scout town scouts are taking active part in clean-up and fire prevention campaigns, conducting walk right, anti-tuberculosis, anti-fly and mosquito drives, doing everything within their power to minimize risk to the health and safety of the public. They know how to act when an accident occurs, but they also know what is perhaps a better thing, how to prevent an accident from occurring. They can and do get persons out of burning buildings and give aid in influenza epidemics, but they also can and do search their home towns for fire traps, and disease breeders so that these terrible emergencies will not come to pass.

If there is one thing more than another that every scoutmaster endeavors to impress upon his boys it is responsibility, that it is their job not only to look after themselves, but other people, too. In a large number of schools scouts are in charge of fire drills, while in others they maintain sanitary squads responsible for the condition of yards and lavatories. In Detroit and in many other cities, the school authorities

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are using scouts to guard congested cross roads near the school buildings, patrols working in shifts.

Merit badges are open to all first-class scouts in safety first, firemanship, public health, personal health, first-aid and life saving.

It is the desire and intention of the Boy Scouts of America to co-operate in every possible way with the National Safety Council and we will esteem it a privilege to act upon any suggestions the Council may care to make in regard to any avenues of service which may be within our power to develop. Our representative on the National Safety Council is Lew R. Palmer, former president of the Council, a member of the National Council, and advisor to the National Court of Honor of the Boy Scouts of America.

DISCUSSION

CHAIRMAN PRICE: The Boy Scout executives are very ready to co-operate in any stunt that we may suggest to them, but the thing that I have been trying to do for several years with Mr. West, the head of the Boy Scouts is to get them to incorporate safety into their daily manual for the boy, so that he will give the same importance to safety stunts, warning people, rescuing people, playing safe himself, as he does to some of the other things that are emphasized.

I believe that there are possibilities there that we have not commenced to touch, and that we in the safety field are partially to blame because we have assumed that the Boy Scout executives are more familiar with this safety movement than they really are.

MR. F. C. HILL (Manufacturers' Association, Bridgeport, Conn.): As you know, most of the Boy Scouts are of school age and in school. Therefore they are doing a great deal of safety work and receiving a great deal of instruction through the schools.

CHAIRMAN PRICE: I was surprised to learn from Mr. West that less than 10 per cent of the Boy Scouts of America are in school. It seemed incredible! A great many of them are working. Of course, they are boys over fourteen or they would have to be in school.

CO-OPERATION OF BOY SCOUTS AND SCHOOLS

MISS HARRIET E. BEARD (Detroit Public Schools): We find the Boy Scouts in Detroit most useful. We use them a great deal. In the schools we ask the Boy Scouts to demonstrate the method of life saving that they have learned. They have a great deal of knowledge that we can command and we feel that it lends dignity to the Boy Scout movement to call upon them for actual service. We hope in time to have a Boy Scout troop in connection with each school. A great many boys are not in the scout movement who would like to be. Perhaps there is no Boy Scout center right near their home or school.

Detroit is one of the very few cities that has a secretary who is employed by the board of education. Half of his salary is paid by the board and half by the scout center there. He has made a survey of all the schools to see how many boys are scouts and how many would like to be scouts. A very large number would like to be scouts, but they seemed

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to have no available troop. So our next move is going to be to get those boys into troops.

They help to regulate traffic also, and form human chains across the principal streets, and they work with the policemen to make everyone cross properly. It has occurred to me that if we could work out some plan to have the Boy Scouts all over the country have an anti-jay walking campaign, or something of that kind, that it would do a great deal to prevent pedestrians from crossing where they should not cross.

MR. HILL: In Bridgeport plans are being made to demonstrate first-aid and life saving in the schools. That will go into effect pretty soon.

CHAIRMAN PRICE: Mr. Hill, you are a Scout man, do you think that it is going to be possible to get safety into the manual of daily practice of the boy so that it will occupy a place comparable with these other things?

MR. HILL: I have no doubt about it. I believe if the National Safety Council would express itself through a resolution to the Boy Scout movement that it would carry weight.

MR. C. E. RALSTON (Yonkers, N. Y.): In Yonkers we are planning this fall to make quite an extensive drive through the scouts and the school work, linking the two together and emphasizing this safety feature of the scout training.

DISCUSSION ON TRAFFIC HAZARDS

CHAIRMAN PRICE: Mr. L. J. Smyth, Manager of the Kansas City Safety Council, who was to present the report of the Committee on Traffic Hazards, has been unable to attend. I understand there are a number of traffic officers in the room. I should be very glad to have one of them start the discussion on traffic hazards.

SECRETARY SMITH: This committee has really done some good work in the past year, but the trouble has been that we have not had the money, at least this section has not had the money, to carry out and push forward the work that the Traffic Committee has done.

One of the things of interest was a meeting in Washington, a national meeting, at which time they used as a basis the motor vehicle code adopted by several eastern highway associations, and they had, I think, something like forty-two associations to approve the ideas that they suggested at that time. They organized a committee and did a lot of good work, and the report of their effort was published in a brief way. The thing that was needed was sufficient funds to put this report out and to get criticism on it and suggestions on it, but the Public Safety Section of the National Safety Council did not have the money to spend on it.

Therefore, the report of this particular committee and the activities of the Traffic Committee, so to speak, are held up temporarily at least. Our new chairman has assured me that he would see to it that enough funds were secured during the coming year to carry out not only that idea and the idea of having the report of the Statistical Committee printed and sent out to you promptly, but any other ideas that may come up during the next year's work.

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LIEUT. J. F. HART (Minneapolis Police): We intend in the near future to put on a campaign in Minneapolis to educate the pedestrians in regard to jay walking. We are going to enlist the Boy Scouts in that. In our last no accident week we enlisted the assistance of the Boy Scouts, directing traffic on the corners, from the sidewalk line or curb line, and it was very successful. I think the suggestion that some of the gentlemen made here about making it a daily stunt of the Boy Scouts would be a great thing.

LIEUT. S. G. NELSON (Baltimore Police): Our trouble in Baltimore is with jay walking. We are trying to do everything possible to overcome that. The pedestrians don't seem to pay much attention to what the officers tell them, and an officer wants to be as courteous as possible towards them, so we have had to try to go along and improve things the best we can. I think an ordinance against jay walking would help to overcome it.

CHAIRMAN PRICE: We had a meeting of the traffic officers and police officers of practically all the towns in Massachusetts some time ago. I think there were about 100 represented, and they appointed a committee and afterwards adopted the Boston system of signals for the state. Do you approve of the Boston system of signals?

LIEUT. NELSON: I would like to go on record of approving the semaphore and whistle rather than the signal. That is what we use in Baltimore.

QUESTION: What towns have ordinances against jay walking?

CHAIRMAN PRICE: I don't know of one.

MR. LLOYD (Birmingham): Our city passed a jay walking ordinance about four months ago. We have had one conviction under it. A few have been arrested.

CURBING JAY WALKING

MR. J. A. DICKINSON (Bureau of Standards, Washington, D. C.): I happen to know that a city in Oklahoma and several little towns in Michigan have such an ordinance and enforce it. In Washington we have tried to get such an ordinance through the district commissioners on two different occasions. The superintendent of police and the traffic officers believe that it is necessary.

Our condition in Washington is rather unusual, because in a comparatively small area at 4:30 we have 60,000 or 70,000 government workers turned loose. The late Mr. Batchelder, the chairman of the executive committee of the A. A. A., took me to the top of the Riggs Building one day at a quarter after four and kept me there for about a half an hour so I could see the entire area around the United States Treasury and the Treasury Annex and the War Risk Building. The streets there were absolutely black with people.

They made no attempt to come anywhere near the cross-walks. An automobilist went through that crowd at his own risk. A great many of those people were not particularly careful of how they crossed the streets, they just bowled across.

I would suggest as a matter of publicity, where there is no ordinance,

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that a series of photographs, showing a big touring car on the sidewalk could be worked into a poster that would make a rather striking presentation of the case. An automobilist who drove a machine on the sidewalk, would be arrested, and he certainly would be decidedly unpopular with the pedestrians. In the same way, a pedestrian who was jay walking could be shown up by means of photographs to be more or less of a trespasser on the automobile highway, and the analogy could be brought out pretty strongly, I believe.

MR. J. C. TOWNSEND (Grand Rapids Safety Council, Grand Rapids, Mich.): It might be of interest to the men who are thinking of this jay walking proposition to know of our experience in Grand Rapids in our anti-jay walking campaign put on through the local council in June. We did this with the full approval and co-operation of the city authorities and police officials.

We prepared for it through publicity in the newspapers, in the moving picture shows, cards to be distributed to the jay walkers, and with the streets having been thoroughly marked out with foot prints leading to the crossings. Boy Scouts were on the job to hand out our cards, and we carried that on for one week.

Some of the people were very indignant over it, as they naturally are when their personal liberty is interfered with, but nevertheless it got across, and the people got to talking about it. The daily papers were commenting on it pretty nearly every day, with the result that jay walking on the downtown streets was practically reduced to a minimum by the end of the week.

We have not had very much jay walking since that campaign. We had no ordinance back of us; we were simply trying to stir up public sentiment in favor of the safe crossing of the downtown streets. While we have noticed a big difference in the people in their crossing of the streets since that time, I think the most pronounced benefit of it has been in the attitude of the traffic officers at the street intersections in that part of the city. They have remembered ever since that the pedestrians should cross the streets at crossings and at right angles and in safety. I have noticed time and again the traffic officers calling attention of the pedestrians to how to cross.

MR. J. H. TRUETT (United Railways and Electric Company, Baltimore): I happen to be on the Pedestrian Hazards Committee of this section. Of course the pedestrian hazard, as I look upon it, is to a certain extent to be governed by public opinion. We haven't got public opinion with us today to the extent that we should have. In some cases you are affecting personal liberty when you keep people from crossing the streets at certain places, but I feel that a law is the only thing that will prevent people from being struck.

In Baltimore in the month of June we held a no accident campaign. It was divided into different days. The first day was trolley day. The second was something else and the third was pedestrian day or jay walkers' day.

I equipped a large double truck flat car with a float, a very attractive one, representing a hospital ward, with a large sign on it, "Jay Walkers'

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Ward." In those hospital cots on the car were the results of jay walking. I had a man on there representing a fellow with a broken leg, a man with a broken arm; I had another man with his head all bandaged up.

I sent that car through the city and it caused quite a lot of comment. The following week my company had more pedestrian accidents than they did for four weeks previous to that, although automobile accidents had been reduced 30 per cent, but I especially noticed that the pedestrian accidents the following week after that drive increased.

CHAIRMAN PRICE: Usually after a safety week you have several weeks where the accidents are reduced.

MR. TRUETT: During this no accident week the pedestrian accidents were reduced, but the week afterwards they increased, while other accidents were reduced.

When a person is in a hurry it is natural that they want to take the shortest route. I do it and always shall do it. Everybody in this room has done it. It is the shortest distance between two points, as my neighbor here says, and it is the natural tendency to take the shortest route.

At the last Congress in the Electric Railway Section the pedestrian hazard subject came up and a man from Buffalo said that they were considering putting causeways under the highways of Buffalo at the heavy traveled sections so that pedestrians might avoid going across the street. In my travels since then I have come in contact with several cities that have used those passageways under railway tracks and under certain streets. In one case I stood and watched what the pedestrians did. They didn't go down the steps and through the passageway and up on the other side; they crossed at the danger point.

MR. A. J. VAN BRUNT (Public Service Corporation, Newark, N. J.): My thought is that there is a possibility of slopping over on this thing, of going a little bit too far in giving the automobile driver the idea that he is not obliged to look out for pedestrians at any other point than at the cross-walks. If we as an organization devoted to safety get that thought across even in the abstract, we will do wrong. Let's be very careful about that.

CHAIRMAN PRICE: Mr. Beyer will give us the report of the Committee on Motion Pictures.

REPORT OF MOTION PICTURE COMMITTEE

DAVID S. BEYER, VICE-PRESIDENT AND CHIEF ENGINEER, LIBERTY MUTUAL INSURANCE COMPANY, BOSTON

The Motion Picture Committee of the Public Safety Section was organized early this year. Following its organization the National Safety Council requested the committee to act as the General Motion Picture Committee of the Council in addition to representing the Public Safety Section which initiated it.

Two meetings were held during the year, one in New York on April 17, and one in Boston on September 28. It was the consensus of opinion that on account of the industrial depression the committee should work

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along the line of public safety films rather than industrial films at the present time.

Three definite plans for securing the pictures have been considered as follows:

1. A Chicago concern has prepared a scenario on automobile hazards which meets with the general approval of several members of the committee who have read it. They proposed to secure sufficient advance orders from automobile clubs, local councils, insurance companies and others interested, on the basis of $500 per copy for a high-grade two-reel film to finance the production. The National Safety Council would lend its endorsement to the plan, but would undertake no financial responsibility. This plan was referred to the Motion Picture Committee by the Executive Committee with power and was approved at the meeting of the Motion Picture Committee yesterday.

In this as in each of the other proposals the most important question is that of raising the necessary finances and the committee would be glad to get in touch with those who might be interested to subscribe to this or to other pictures on the basis mentioned.

2. One of the regular motion picture producers in California some time ago produced a picture on fire prevention for the Los Angeles Chamber of Commerce. Some of the local representatives of the council believe it would be possible to have a safety picture produced without cost provided a suitable scenario were secured for a good one-reel film. One or two scenarios have already been submitted, but nothing satisfactory has been secured as yet.

3. If sufficient demand develops and the Motion Picture Committee is assured of the necessary finances on a subscription basis, it is ready to proceed with the production of a picture on its own initiative. The members of the committee have little time, however, to devote to selling the copies and the demand must develop automatically on the part of those desiring to use the picture. It is doubtful that we could hope for this situation to materialize before present industrial conditions improve.

To summarize the situation,—we believe there is a fair possibility of having one picture produced within the next year on the automobile hazard as outlined in proposal No. 1.

Aside from this it will greatly assist the work of the committee if ideas for scenarios are submitted (these may be in simple story form).

Those willing to subscribe for films on the basis of approximately $500 per copy of two reels, should make this known to the committee.

DISCUSSION

Chairman Price: I would like to ask you about the practicability of getting little trailers of a couple of hundred feet; their value, and the possibility of getting them run in the theatres, and the practicability of getting them produced with less expense.

Mr. Beyer: We have talked that over with several of the people who get out the news weeklies and the producers. That was done more or less during the war, but like a good many other war activities, it is a

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thing that the producers frown on at the present time. They have all sorts of requests, of course, for so many people would like to get into those news trailers, and we haven't had any encouragement on the proposition, except in the way of a special demonstration such as we are having during our safety week here, where they feel it may have enough news value to get into the trailers through the regular news channels.

I don't know whether you know just how those things are prepared, but there are hundreds of camera men all over the country who take events that they think are of local or national interest every day and send them in to headquarters in New York. Thousands of feet of that material are gone over every day and edited, just as newspaper matter is, and anything that passes has to have pretty striking value in order to attract the people who are doing the editing. We don't feel very hopeful of getting anything along that line.

SLIDES AS SAFETY MESSENGERS

MR. DAVID R. FARIES (Automobile Club of Southern California, Los Angeles): I might say, in connection with the safety films, we have found it very much easier in our part of the country to have some slides made up which the picture theatres have agreed to use. We had ten series made, each series consisting of three or four slides.

We had slides illustrating the different signals to be given by an automobilist before turning a corner or before stopping; also a slide headed "motor pests," a picture of a man doing something that was against the law which aroused the animosity of every other motorist and in that way making fun of the motor pest.

We put those on different slides and we found that the theatres would all very gladly make use of them. They simply ran them in between their pictures. Those slides cost us 25 to 30 cents apiece. A series of three or four slides would cost us a dollar, and we had ten copies of each slide made. So that a whole series would cost us about ten dollars. It made very good work at a very low cost.

COST OF SAFETY MOVIES

As to the making of motion pictures: it seems to me that what Mr. Beyer has said indicates that the price to be charged for these films is rather high. I happen to be a director of a motion picture company, a very small affair. I would say that the prices that have been quoted are too high entirely. I also know that the Los Angeles Chamber of Commerce, for instance, on their fire prevention film didn't pay anything like the price that has been indicated. I might say that I am a member of the committee of the Los Angeles Chamber of Commerce that helped to get out that fire prevention film, so I know something as to the price.

As to the automobile club work, we have under consideration at the present time propositions from a number of motion picture concerns to get out a series of 26 one-reel pictures during the coming year. We were told that one-reel pictures would do better with the motion picture houses than the ordinary two or three-reel pictures, that they wouldn't

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give us the time for that, but they would give us the time for a one-reel picture.

I might say that we would not have more than three or four paid actors in each picture. For example, the paid actors would consist of the members of the party in one automobile who would travel around and see different sights, and also, in connection with the safety work, it was thought of having this one automobile, or possibly in some cases, two or three automobiles, with only one or two persons in each machine, illustrate the various things which should be done and which should not be done in driving a machine.

GUARDING AGAINST COMMERCIALIZATION OF SAFETY FILMS

One of the largest motion picture producing concerns in the world has offered to produce those 26 pictures for $26,000—a thousand dollars a reel. They have said, "If you desire, we will undertake it and do it free for you, if you will let us handle it in our own way." I don't know what the Chicago proposition is, but we don't want this motion picture company to handle it in their own way.

Here is their own way. They propose to go to the manufacturers of the Buick or Cadillac cars and say, "We will use your automobile, provided you will give us $1,000." They will go to the William Wrigley Company and say, "We expect to show your big sign on the roof of the largest building in Los Angeles, provided you give us $200." The net result would be that they would make a lot of money out of it. They would simply commercialize it and spoil it for any effective safety work or even scenic possibilities.

So those things have to be guarded against, and you certainly would have to keep the editing very strictly within your own hands if you entered into a contract of that sort.

GETTING THEATERS TO SHOW SAFETY PICTURES

I might say that to me the big problem is not the producing problem or the financing problem, but the problem of having the picture shown in the desirable houses at regular times and on a regular schedule instead of just turning it over to some independent releasing agency who will use it to fill in space wherever they haven't got something else that they think will be more attractive to the public.

We have one chain of forty-two theatres in Southern California which has offered now, after some months of negotiations, to take the series of pictures that we propose to produce, provided they can have the exclusive right to use them in southern California. They say that they will take those pictures and run them regularly at various places throughout southern California provided we will in our publicity matter notify the public living in that locality that on such and such a date the picture will be shown at that house.

So it works both ways. They are very glad to get the picture provided we will advertise their motion picture house. In fact, they have indicated that they will pay for the picture provided we will enter into

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that kind of an arrangement with them or they will give us a royalty on the receipts which are received from the showing of the picture.

It seems to me that the trailer idea, while desirable, is hard to get over because, as has been mentioned, the picture producers get pretty tired of it. It breaks up their program and they don't like to be bothered with it, but if a local man will go to them with a local safety proposition on slides, they will put them in every time because it only takes a minute or two, and if they are well gotten up, they will be used. We had a local cartoonist draw them in most cases. Some of them were photographs, but the local cartoonist drew many and was very glad to do it for nothing in fact, nothing except his name down in the corner—which of course, was his form of advertising.

As to the larger picture, the whole thing depends, as Mr. Beyer said, on getting a good scenario. If you can get a story that does not look as if it were written simply for the moral you can not only get it over, but you can probably sell it, or at least get it over in such a way that it will cost you a minimum amount of money.

MR. BEYER: We have been working on the slide proposition; in fact, some are being made up at the present time here. I do think that is a feasible way of getting pictures into the theatres that will reach the people in the proper way. We have not attempted to approach the theatres on it except with our safety week slides, where we had a good response. We have had some requests from local chambers of commerce and other people which indicate that there is an interest and perhaps a demand developing which could easily be fostered along that line. So far as cost is concerned, it is possible to get pictures from about 75 cents up.

The gentleman spoke about scenic pictures. Fortunately nature will compose without any charge, but when you come to get real talented actors or actresses, they want a rather substantial sum for acting. The criticism that has been frequently made to members of the Motion Picture Committee is that there has hardly been a real picture go out yet on safety lines, because of the expense of getting adequate actors and direction. A good director is another expensive item in the make-up of the picture, and to get men with experience and ability to put this thing across dramatically is a problem that involves considerable expenditure.

My own company produced a picture about a year ago, after consulting with a great many people and getting estimates and bids; where we thought we could get a picture for one or two dollars a foot, we paid five dollars a foot for it, a little more than that in fact. That included professional actors and direction and scenes, which we think are up to the professional standard.

The members of the Motion Picture Committee with whom we have discussed this matter were very anxious to bring out something that will be high grade and unique and appeal to everybody as being a first class job.

TRAILERS MOST POPULAR TYPE OF SAFETY PICTURE

MR. TOWNSEND: Just along the line of the type of reel that might appeal to the moving picture men, I personally approached all of the

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moving picture men in our city, and they have done some work for us, but they all express the opinion that they would much prefer trailers to anything else. They said, "We don't care, as a rule, to use slides; and as to putting on a two reel picture, we don't care to do that, though we will do it to help out the cause, but we prefer, above everything else, a two, three or four minute trailer that we can simply attach to the feature, to something else that we are running regularly, and every time that particular thing is run, your trailer will appear also. We will be very glad to use that sore of a reel."

CHAIRMAN PRICE: Has any one else had experience with the theatres in putting on trailers? It has been my impression that they were willing to put on a trailer but would not want to put on a more ambitious film.

MR. H. B. HARMER (The Philadelphia Electric Company, Philadelphia): An extensive survey was made about two and a half years ago for the National Electric Light Association, with the idea of putting on a resuscitation film, and contact was had with all the universal producers and distributors of films, to find out what would be acceptable to the exchanges.

The concensus of all was that trailers were the only logical solution; notwithstanding that they wanted all the way from $1,000 to $50,000 to produce our film, they all advised trailers.

MR. BEYER: Might I ask if your committee succeeded in getting any of those trailers in use?

MR. HARMER: No, because of the fact that the committee on account of war conditions stopped that particular activity and they have not functioned since.

SECRETARY SMITH: I would like to answer your question on that point. I had a conference in Pittsburgh with operators, owners, and agencies or release men, on this question of trailers. They all agreed that it was the only thing, and the people who released the films over in western Pennsylvania and out through that territory agreed to see that these trailers were put on every film sent out from that district, regardless of where it went. All they wanted was to have the trailers sent to them and they would attach them to the feature pictures before shipment was made. They were simply shipped out into the territory and shipped back and detached.

CHAIRMAN PRICE: I wonder if we do all understand that a trailer is about 200 feet, runs for about two minutes, and can contain only about two or three incidents. Mr. Dow, who has produced one or two very successful films told me that during the war one of the largest producers came to him and offered him a very handsome sum to produce one safety film trailer a month. I think he was to produce twelve and they were to run a minute and a half each. He was not able to do it at that time.

He was of the opinion that it was entirely possible to connect up with these big producers, and if we could produce films, as he said, that are not propaganda but that had news value—it would not be difficult.

MR. HARMER: The moving picture people here in the east will do that for you free of charge, if you have anything to suggest to them of news value along the safety line, and will run it in all the shows with the

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weekly events. They will be glad to do that with no cost at all and will give you a copy of that film to use for your own needs. We have secured a dozen of them at no cost to our company.

CHAIRMAN PRICE: We shall hear from Mr. De Armand, chairman of the Publicity Committee of this Section.

REPORT OF THE PUBLICITY COMMITTEE

LOUIS DE ARMAND, COMMISSIONER OF PUBLIC SAFETY, DAVENPORT, IA.

We had a little conference yesterday afternoon and we would like to try an experiment during the coming year. For instance, the Grand Rapids man had a campaign. If we could get the details of it we would be willing to make carbon copies of it and send it out, using it as an example. The idea may be old to some of us but there would be something in it that was new to somebody. The original of that report would be sent to Mr. Resnick. If there is anything of value, as he sees it, that can be used throughout the United States, of course he wants it for the *National Safety News*.

I want to warn any of you who care to co-operate with us on this that if you do not see your name, or your item, in the *National Safety News*, do not condemn Mr. Resnick; he gets hundreds of bits of publicity matter that seem to some of us very new and original. To him it is old stuff. He can't print old stuff in the *National Safety News*.

We also want to start a little propaganda on behalf of the *National Safety News*. In Davenport we have six men on three shifts—that makes eighteen men a day in the patrol barn. It is a small city and we have only one patrol barn. Those eighteen men see the *National Safety News* every month. When I get back, some arrangement will be made with the National Safety Council so that we can get enough copies to cover the central fire station, and I hope every fire station. I find that the policemen and firemen read the *News* from cover to cover.

We also discussed yesterday the force back of this courtesy movement that is now spreading throughout the country particularly among public service corporations, the street railway companies more than any other. We agreed that the courtesy movement was good in its psychological effect upon people. An individual who is courteous is careful; he must be; he must be on his guard. One cannot be courteous and push into a street car, push ahead of women and children. One cannot be courteous and run across a street. A motorist cannot be courteous who tries to run down pedestrians. So if your railway company, for instance, has not followed in the wake of Detroit, the Fifth Avenue Coach Company of New York, and public service concerns of several other cities, in putting on a courtesy campaign, it might be well to interest them in it.

With reference to the exchanging of ideas, here is a thought that came from Philadelphia. Green cars, grey cars—any dark-colored moving object is more hazardous than a yellow object. In Philadelphia the traction company painted their cars a color that actually could not be seen. The color of the car blended with the surrounding buildings. They changed to a green car with yellow marks on it. Now they can be seen.

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You can see the advantage of that when a pedestrian is crossing a street. He is looking possibly in the wrong direction, but if he does look that way, if the object is yellow he sees it; if it is green or black, he may not see it.

CO-OPERATION OF AUTO CLUBS

I would like to give you a warning about auto clubs. When we as safety men ask the co-operation of auto clubs we should be prepared for this: either the auto club will pay no attention to us or they will enter into our little idea or plan and hop at the chance to do something. As secretary of an automobile club for a number of years I know what the board of directors of my club wanted me to do. If anyone made a suggestion that would help a motorist we were to take complete charge of it and get all the publicity that we could out of it.

In that community of 200,000 people, consisting of four cities within 12 minutes' motor drive of each other, connected by street railways (not interurbans), where the cities run right into each other and you can't tell one from the other, three motor clubs are now combining to take up traffic matters. I am here to tell the world that there is going to be some fun. We have worked for three or four years and we are perfectly willing to have some one co-operate with us, but we don't want the system that we have devised jimmed up now by outsiders who assume that they know as much as we know.

I am perfectly willing to be consulted and to enter into a co-operative campaign, but I don't want a number of old rules brought in. Take, for instance, the subject of jay walking that was brought up here, we have an ordinance and our judge co-operates with me, and the chief of police does, and I am more interested in it than the chief is; he co-operates with us and he fines a man a dollar and costs, which is $5.85 for crossing a street at the wrong place. The mail carriers petitioned to be permitted to cross the street at any point. I said, "You can cross the street anywhere you want in Davenport and you will not be arrested; but if a motor vehicle or any other vehicle hits you, in my opinion you will be held liable for any damage to the motor vehicle." Then they immediately withdrew their resolution or petition; I gave it to the newspapers and everybody laughed, but in laughing they saw the danger of crossing the street at the wrong point.

DISCUSSION

CHAIRMAN PRICE: I have learned one thing in New England here that is more important to me in the no accident week campaign than anything I have learned on publicity. It is this: in our publicity we have been too prone to be content with just news or playing up the fact that there was a meeting and that So-and-So spoke, etc. I think that we ought to emphasize constructive and instructive publicity.

Dr. Payne made the statement that practically all children killed on the street are killed in one of four ways. Suppose you play up those four ways with definite instructions to the mothers how to teach the children to avoid those four ways. What splendid publicity that is—it attracts the attention of people and they read it.

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I think that a great deal of our publicity has been froth. It really does not grip the mind of the person. It does not do anything constructive and it does not accomplish much in the way of making the man who reads it more careful. I remember that Mr. Harvey and I wrote some forty two-minute talks and ran them in little boxes. They have been run by newspapers in other cities and they have been the most popular pieces of publicity that we had so far as the response of the public was concerned.

GETTING BUSINESS CONCERNS TO PAY BILLS FOR SAFETY PUBLICITY

MR. A. H. LINTZ (Cleveland Safety Council): We are putting on a fire prevention week in Cleveland and we are reaching the schools very thoroughly. Here is an idea for saving money. We conceived the idea that if we would put into that pamphlet something about the danger of dry cleaning in the home, that we could get the dry cleaners to pay for it. We put one little sentence in there about not dry cleaning at home, and filled the pamphlet with a lot of other fire prevention ideas, and the dry cleaners paid for 120,000 of them.

MR. DE ARMAND: We have a headlight law that compels a man to have a direct ray lens that will not shine over 42 inches from the ground and 75 feet in front of the motor vehicle. He must drive with bright lights in the State of Iowa. I took excerpts from the law and had them printed on the front of a little booklet, and on the back was an advertisement for a bank, which paid for putting out 5,000 of them. They were tickled to death to do it.

CHAIRMAN PRICE: In connection with the program for the Boston no accident week, 15,000 pamphlets were printed by the John Hancock Mutual Insurance Company without any cost to us. I have learned a good many tricks down among these Yankees here in Boston in running a no accident week without spending any money.

I will be glad to hear further discussion on this publicity question. There are great possibilities in it. I was impressed by what can be done in a no accident week in connection with Baltimore. They managed to hornswaggle the Executive Committee in thinking they ought to send me down there for a week and against the judgment of all of us, they wanted to conduct a no accident week. There was no school, hot weather, a short time to prepare for it. I had to concentrate on a few things. Baltimore went through a week with no deaths as compared with nine, which was the average for the summer before. Now why? Because the newspapers went at it strong and because the poster campaign was well done.

One of the interesting things they did there, and we are doing it here, was that instead of keeping still about accidents, they played them up. If a child was injured, they would play it up. Just the accumulation of those stories right in a string on the page, of people that were injured, was a new idea to them. They played them up in order to grip the people.

MR. O. T. REMMERS (Anheuser-Busch, Inc., St. Louis.): We have employed a publicity man. We are running the safety council as if we were running a commercial enterprise. When we need a man of certain talents to accomplish a certain purpose, we employ him so he will devote his

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entire time and energy to the work and not try to run a business and do publicity on the side. This man is getting publicity into the newspapers. In one week we had two or three cartoons. We have had a number of columns of news items.

If some of the more powerful local councils who can afford a publicity man would consider this matter, they would find it profitable and find that the publicity man is a satisfactory investment.

SECRETARY SMITH: I might add that one of the interesting things on the question of publicity that was brought out was the fact that very few motorists know the traffic laws. Judge Mix of St. Louis made the suggestion that the Publicity Department of our Council make every effort to get the traffic laws across in the papers.

CHAIRMAN PRICE: I am reminded of a thing that the Rochester chief of police did. Once a week he would give an interview to the papers and he would select some striking accident and would hammer the safety lesson home. He would make that recklessness just stand out, and put the stamp of ridicule upon it, absolutely. He put a punch in it, and he could do it because he was the chief of police. It was splendid publicity.

MR. LINTZ: Here is another idea that I don't believe has ever been worked out before. You have sections in the paper and you have pages in the paper on safety of an advertising character, but I don't believe that anybody has ever had a section in the paper with the advertising headed with a write-up on safety from every civic organization in the city. We are putting that on in Cleveland next month.

There will be safety material interspersed among the advertising of various civic organizations and it will be headed up by a write-up from the President of the Cleveland Safety Council.

LIEUT. HART: I would like to say that our newspapers are co-operating with us in a splendid way.

Our mayor and chief of police are very much interested in safety and are giving full co-operation to the safety council in this work.

CHAIRMAN PRICE: I would like to have Mr. McBrayne close this discussion on publicity, and ways and means of getting it.

MAKING SAFETY PROPAGANDA LIVE NEWS FROM THE CITY EDITOR'S STANDPOINT

MR. L. E. MCBRAYNE (Massachusetts Safety Council, Boston): In the first place, gentlemen, you must have something new. You can't get any editorials over as a release. Second, you must not shoot a whole bundle of it and then do nothing for six weeks. If you can give out a story as the result of some definite thing, it will receive very wide publicity.

To illustrate, in making a study last year of the increasing automobile hazard, we found that we had a 25 per cent increase in motor vehicles and a 100 per cent increase in accidents, and that every day and night for one year an automobile had knocked somebody down. We played up our first story along those lines. Then we made a study of the causes, and on the side of the automobilist we found one of the troubles was speed; and on the pedestrian's side, 50 per cent of the trouble was caused by the child, and that the child was responsible, although the law said the driver caused the accident. We wrote a story on that.

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Later we took another group and found that a large number of accidents occurred because of three things. (1) You cut in when your view was obstructed 200 feet away; (2) you tried to cut in on a curve when your view might be obstructed by a truck coming around or by a natural obstruction of view; (3) near the top of a hill you went too fast with the car—shooting over. We sent out a story, "There is an accident waiting for you if you do one of those three things long enough; it may be delayed but it is there and we have got figures to prove it."

We put out a succession of definite stories. On the children's end of it we got out a little leaflet called "Ben Hur's Chariot Race and the Automobile." We got an artist to design the cover; we based our information on an analysis of a very large number of accidents which had injured 2,700 children the previous year. We wanted to visualize the thing for the child. So we said that in the days of Ben Hur's chariot race, nobody ever got in the way of the chariot, because they knew it was dangerous, but that Ben Hur's fastest chariot was slower than the slowest automobile today, and that there were 100 times more automobiles on the average than there ever were chariots, and yet the modern child would get in their way.

We said, "This is the co-operation we want you to give, and we offer them in the form of ten commandments." We gave away a great many of these for instruction purposes. The paper with the largest circulation in New England ran the ten commandments, one a day, with an original drawing. It gained very wide publicity because we offered definite approach to one of the problems.

Not long ago we had a meeting of 90 per cent of the street railways of Massachusetts. We sat down and said, "What is our risk today?" It used to be getting on and off the cars. We discovered on two roads that 50 per cent of the trouble was with automobile collisions. We found that the hazard of collision now was greater than getting on and off the cars.

Then we sent out a story—that such and such a meeting had been held, such and such a study had been made, and that we find that 80 per cent of the accidents are caused by the effort to cut in front of the car, and that the safety council is about to call upon automobile organizations of the sate to ask the co-operation of their members in not cutting in front of cars.

Our next step is to get our reports, up to the first of September, from seven roads, covering practically the whole state. We find that there have been more than 5,000 collisions of automobiles in that period, and we say to the average driver, "You wouldn't take these chances if you realized that more than 5,000 men who did take them had missed."

CHAIRMAN PRICE: Mr. Secretary, will you read Dr. Kohler's report?

REPORT OF COMMITTEE ON PEDESTRIAN HAZARDS

DR. C. H. KOHLER, MINNEAPOLIS, MINN.

It is found that in most cities other and more important phases of safety work, together with the very depressing business conditions, did

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not warrant this phase of the work being pushed as it should have been during the past year. In other words, many local councils were faced with a financial situation that compelled them to devote much time getting sufficient funds to carry on the work, which time would ordinarily have been devoted to pedestrian hazards work, so that other cities like our own have been devoting most of their time to educating the automobilist. However, in cities where the councils are firmly established and not handicapped by lack of funds much good has been accomplished in connection with this committee's work without sacrificing other important activities.

JAY-WALKING ORDINANCES

In Milwaukee, we understand, legislation regulating pedestrian traffic has actually been incorporated in their city ordinances. St. Louis has, through various agencies, done considerable publicity work in connection with their campaign for pedestrians. Kansas City has done likewise. In Los Angeles extensive plans have been laid for activities along this line, and the results of the educational campaign conducted by the Grand Rapids Council were very gratifying. The Chicago Council, it is understood, has approved of a jay-walking ordinance, and Delaware used professional jay-walkers for ten days to walk the streets of Wilmington as a first step in an anti-jay-walking campaign, giving same demonstrations in twelve other towns of the state with lectures in motion picture theatres and to children in the classroom.

ANTI-JAY-WALKING CAMPAIGNS

The most popular activity in connection with pedestrian hazards seems to be an anti-jay-walking campaign, but there are many things which should be done besides instructing the people in the proper use of the streets when walking, and your chairman believes that a systematic all-year-round campaign should be in force in all cities rather than have this work carried on in a sporadic manner. For instance, in the city of Minneapolis many open outside stairways of old structures have been protected by the installation of guard rails and in the case of proposed buildings architects have been requested to design these stairways so that the opening would not be facing in the direction of oncoming pedestrians; outside showcases and fruit stands (which are in many cases hazards to pedestrians) were reported to city authorities; likewise uneven sidewalks. The citizens' police auxiliary has been instructed to report dangerous conditions surrounding new buildings; holes in pavement; manhole covers left off and openings not properly protected; to report all pedestrian hazards that come under their observation, and the Boy Scouts have been used to assist in directing traffic at busy down town corners. This work is going on continuously.

This committee recommends that where a council has been established its pedestrian hazards committee use as a basis for their operation the activities mentioned above to which would be added, of course, any others that they may originate. In order that all councils may be benefited by such activities each local should, in their monthly report to the

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Chicago office, outline methods used in connection with this phase of the work.

DISCUSSION

MR. TRUETT: There are a lot of things that have been said about the pedestrian accident matter in connection with the down-town sections. That same thing applies to traffic accidents. Very rarely do you hear of a serious traffic accident in the center of the city, because the traffic is slower, it is governed by traffic officers, but where the most serious pedestrian accidents happen is out in the outlying districts where there is no traffic officer. My experience has been that in the majority of cases where accidents happen in the congested section of the city, the machine or car was operating at slow speed or was under such complete control that the injury was very slight, but in the outlying districts, where there is a collision, the accidents are in most cases serious.

CHAIRMAN PRICE: We never got anywhere in industrial safety work until we developed an organization, beginning at the top, which had authority and support back of it such as a general manager can give, so that it commanded the attention of everybody. I believe the same fundamental principle applies to public safety. Accidents are increasing and we wonder why. I don't believe there is any solution except to develop an organization made up of people of sufficient standing who can command the attention and confidence of the public. Put public safety on the map; give it publicity, develop a program, an educational program through the schools and through the newspapers.

Then it will attract the attention and grip the interest and finally come to occupy a place in the minds of people just as good morals or good health now do.

PEDESTRIANS SHOULD WALK ON LEFT SIDE ON HIGHWAYS

MR. FARIES: We have found that some of our most serious pedestrian accidents were the cases in which an automobile was travelling along at a pretty high rate of speed, just within or a few miles over the legal limit at night and would run into some pedestrian from the rear. The pedestrian would be walking along the road in the same direction that the automobile was proceeding.

I have attended quite a number of coroner's inquests on victims of such accidents. The usual explanation of the motorist is, "Well, the man was wearing a black suit and I couldn't see his face. It was a dark night. There were no street lights and the moon was not shining and trees blanketed the road so that it was dark all along. My lights were pretty dim to comply with the law, and a machine with glaring headlights came along from the opposite direction. I pulled over to the side of the road, came almost to a stop, and as I did I heard someone scream, and I realized that I had hit somebody." I thought that was a lie until I had almost a similar experience myself when I was out one night.

It seems to me that there is a great deal of merit to such a defence when it is brought up by the motorist. I think this Committee on Pedestrian Hazards should give very serious consideration to a rule

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which would require pedestrians to walk on the left side of the road when there is no side-walk. If the pedestrian is walking on the left side of the road, he sees the lights of the oncoming machines and oncoming machines have a better chance to see him because of the color of anything that is white.

It seems to me that the committee might be asked to carefully consider the advisability of having the National Safety Council advocate the adoption of a rule requiring pedestrians to travel on the left side of the road.

MR. WEBSTER COLBURN (Dorris Motor Car Company, St. Louis): That is an excellent suggestion. There is one thing that I would like to add to it. During these days of highway building, there is very little thought given to the pedestrian. Most of it is given to the vehicle, and several months ago I wrote to one of the men connected with a highway problem in Missouri, and suggested that in building the highways near the large cities and towns, that a sidewalk be provided on one side of the road for the benefit of the pedestrians and the people living in those country neighborhoods.

MR. REMMERS: A hobo always walks on the left hand track. In other words, he never walks in the same direction that the train is going, but always in the opposite direction, so he can see it coming. If you can play that up and try to connect it with the pedestrian, the thing is more or less easily visualized, and they will remember the story of the hobo and always walk on the left hand side of the road instead of the right.

MR. M. G. LLOYD (Bureau of Standards, Washington, D. C.): There is one other answer to this question of the pedestrian on the country road and that is the use of proper headlighting devices on the automobiles. Most cases will be taken care of by having proper headlights, and I think every one interested in public safety should make an earnest effort to have proper specifications for headlights adopted in his own community.

ADJOURNMENT.

FRIDAY MORNING SESSION

CHAIRMAN SMITH: The first report this morning is that of the Vigilance Committee.

SUCCESS IN VIGILANTE WORK

ROBERT E. LEE, CHIEF VIGILANTE, ST. LOUIS SAFETY COUNCIL, AND SECRETARY, ST. LOUIS AUTOMOBILE MANUFACTURERS AND DEALERS ASSOCIATION, ST. LOUIS

The experience that St. Louis has had with the work of a traffic vigilante committee has been more than satisfactory—it has been distinctly profitable from the standpoint of safety. The slogan of the viligantes of St. Louis is "Make St. Louis the safest city in the world to

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live in." At this time our organization consists of about 325 vigilantes and the only publicly known one of them is the chief vigilante, who is the writer. We have maintained this secrecy about our organization for several reasons, because of the psychological effect in holding out to the general public, particularly the motoring public, the thought that there are a great number of keen-eyed, determined men watching to see that the law is not violated and watching at the time when the uniformed policeman is not around.

It is a patent fact that a man will not drive past a street car when it is unloading passengers if there is a uniformed policeman close at hand, but the same man would try to sneak by if he did not fear that the motor car behind him had in it one of those Argus-eyed vigilantes. If that vigilante carried some visible mark of identification on his car or his person he would be as conspicuous to the law violator as a policeman would. We feel that it is the secrecy of our work that makes it most effective.

HOW VIGILANTES OPERATE

Our plan of procedure is simplicity itself. If a vigilante sees a traffic violation he catches the license number of the offender. On one of the number of blank post cards which he carries in his pocket he checks the particular offense committee (the post card indicates about twenty), signs his vigilante number, filling in the time and place of the occurrence, and this card is mailed to the chief of police.

At the office of the chief of police, the safety council's vigilante division maintains a stenographer, a clever young lady who knows in most instances what to do. All of these post cards are turned over to her each morning and she sends out on each one a notice to the offender telling him what and where and when his offense was, and instructing him to make a written explanation thereof to the chief of police. In some very flagrant or major offense the offender is given peremptory orders to report in person to the chief of police to make explanation as to why he violated the law.

We find by this method that we secure the good will of the police department because the report of our work is published each week in the *Police Journal* which reaches every police officer, and we find that it is felt that the vigilantes are really auxiliary policemen who must be considered at all times and helped. The board of police commissioners of the city warmly approves of our work and renders every possible assistance and the chief of police gives his heartiest support to us, and his hardest third degree to the offender who comes by invitation to see him.

Our vigilantes have been very active. There have been weeks when they have turned in as many as 2,000 reports of violations. That was when a special drive was on. The normal number of reports per week is 600. These cover practically every item of traffic law violations including no lights and one light, but our best attention as vigilantes is given to the major offenses such as reckless driving, passing street cars when loading, passing corners at high speed, and others of a dangerous character.

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CARE IN SELECTION OF VIGILANTES IMPORTANT

We have been very careful in the selection of our vigilantes, our care arising from the fact that we made a few mistakes in the beginning. Our appointments of very young men have not been satisfactory because they used the badge which was furnished them either to intimidate, to get out of trouble themselves, or to "play smart". Our personnel now consists of men ranging from thirty to fifty years, and all are men of excellent standing in the community. I find that the bigger a man is in the business world the more anxious he is to help make his city the safest to live in.

Our total experience up to this time with the vigilantes as an important branch of safety council work has been highly satisfactory and we would not recede from it nor drop it. In addition to the fact that it keeps down tremendously the number of street accidents and casualties it has a marked advantage to the local safety council itself in that it frequently furnishes opportunities for good newspaper publicity which do not arise from the more prosaic safety work done in industrial plants or schools. I mean by that that we are the sensational end of safety work, but we see to it that all of our publicity reverts back to our parent, the safety council.

DISCUSSION

MR. ANDERSON: Our committee is composed of two hundred members. They are selected by a special committee of five men and approved by the chief of police, where they operate in a city; and by the sheriff, where they operate in a county. They are also provided with the usual postal cards and forms, etc., that they send in, which go direct to the police station.

The police department has assigned a motorcycle officer (their best one), to devote some or, if necessary, all of his time to the handling of these reports. For example, they will get in at police headquarters, possibly fifty reports in one month. These cards go direct to this motorcycle officer and he first goes to the records and finds the name of the owner of the automobile and his address.

The report card is so designed that the first ten violations are classified as major violations, and the last ten as minor violations.

There is an understanding between our division and the police department that the major violations will be the ones which the police department would handle. This motorcycle traffic officer can get around quite handily. When he gets in a report that we will say is No. 2, passing a street car recklessly while it was taking on or discharging passengers, he calls the vigilante who made that report and goes over the case with him. Then, if it is a good case, he asks the vigilante, if he does not want to take it to court. In nine out of ten cases, he says "Yes", and they go ahead and arrange to serve a warrant.

We have taken hundreds of cases to court and we have never had one fail yet. In other words, they have all gotten ten, fifteen or twenty-five; and we have had three cases that have gone up for sixty days—that was for driving while intoxicated.

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The motorcycle man who handles these reports, after he divides them between the major and minor, brings the minor cards to our office, where we have a young lady who devotes approximately a third of her time to handling all the records in our office, and a firm but courteous letter is written to the offender. We keep a card index record and where there is a repeater (we seldom have one) we go after him a little bit stronger.

MR. S. H. REID (Bureau of Safety, Chicago): Do you have any opposition on the part of the automobile association to this work?

MR. ANDERSON: No sir—we have their hearty endorsement.

MR. HILL: Do you have meetings of the committee?

MR. ANDERSON: Every month. The attendance averages around ninety to one hundred and ten. We have the highest type of business men on this committee; but it isn't always possible for them all to be there. I find that is one of the things that keeps them pepped up, and you certainly get a wonderful lot of good suggestions as to traffic conditions through that committee.

VIGILANTES WITH POLICE POWER

MAJ. HAVEN: I think the conditions in Minneapolis, so far as the organization are concerned are practically the same as in Milwaukee. We are somewhat unique in one way. Instead of giving the vigilante police power, we have what we call special officers in addition to our citizens' police auxuliary—citizens who have police power and who go out and do regular guard work along police lines, where glaring headlights, and one eye, as we call them, and no tail light, are in evidence. That is a special corps that has been in existence for about four years. Last year we organized our citizens' police auxiliary with 450 members.

LIEUT. HART: Our system is that all the offenders are called into one office and talked to and furnished with a set of traffic rules; and at nine o'clock every morning, there are from fifty to one hundred people in my office. Of course we continue all the morning, and there is a great effect on the balance of the people when we talk to those who are sent in by the police auxiliary. They don't know who is driving in back of them, or who is on the street cars watching them violate the safety rules.

In ninety-nine out of a hundred cases they admit their violation when I call them, but offer some excuse. I explain the danger.

We very seldom have to call a witness into court. If it does happen after they have practically admitted to me having violated the section, that they plead not guilty in court, the case is postponed until the next day, and in the meantime we get in touch with the witness.

FINANCING OF VIGILANCE COMMITTEES

MR. WYSE: How are the vigilance committees supported, and are there any fees attached to the membership?

MR. CALDWELL: That is a question that is puzzling us just as present. Our entire public safety work is financed by the community chest. It is now an open question on our part as to whether we can increase our budget by assessing. It would have to be voluntary on the part of the

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vigilance men. There would be a very small pro-rata cost for the postal cards and printed matter used; and I fancy we will have no difficulty in collecting it if we can get them to see it right.

As far as the financing is concerned, there isn't very much to be done. The Cleveland vigilance committee, or, as we call it there, the citizens' police auxiliary, is a citizens' branch of the police department. The men carry cards identifying them as members of the police department, without authority to arrest. That is subject, however, to explanation. Of the 850 whom we now have, 25 are deputized as policemen with power to arrest. They can operate in the city or in the county at large.

I think Mr. Anderson brought up the question as to whether it is worth while to have men deputized with power to arrest. We have had no trouble so far. We have had trouble with some of our other men in misusing the tags which we supply them for their automobiles. They carry on their rear license plate a C. P. A. tag—the universal cross with C. P. A. and C. S. C. (Cleveland Safety Council). That is in some cases attached to both front and rear license plates, but usually only the rear. It has two effects. A man seeing one of those cars ahead does not know whether there is a deputized officer in there or not. On the other hand, the danger is that a man may stop violating speed laws for ten minutes and then start it up again.

Aside from that I think our vigilance committee is organized and functions as it does in other cities. The chief difference is this: The C. P. A. man sends a post card to go direct to the chief of police; and the chief of police at once sends out a formal letter, calling attention of the violator to the fact that he has been reported by an officer of the police department, and that his name has been placed on record.

We find that nothing is being done by the police other than filing those cards, because they are coming in in thousands, and the office is swamped, with the exception of cases where a violation is so severe that the C. P. A. man himself calls up the traffic division of the police department and requests that the man be called down to the police headquarters for a conference. The man is called down by the inspector or his assistant, and the C. P. A. man notified as to when he will appear. They get together and a man is faced with this charge; and if his attitude is such as to warant it, or the violation is severe enough, the warrant is sworn out.

We are finding, as I say, difficulty in keeping the records. I presume that is the weakest part in our system.

Mr. C. H. Stewart (Laclede Gas Light Company, St. Louis): There has been some mention about the financing of the vigilance committee work. We have a public safety budget in St. Louis, and certain provisions are made in this budget for the expenses of the vigilance committee. In addition to that, we require each vigilante to deposit one dollar. We have been issuing badges and credential cards assigned by the chief of police, and each vigilante was requested to deposit a dollar to cover the custody and return of this badge or credential card.

We are considering now annual dues for the vigilantes, a nominal sum, one or two dollars a year, simply another little method of getting

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a little more money in for our expensive work there. The matter has been discussed informally and there really has been no opposition to the plan.

We are also considering doing away with the vigilante badge. There really is no reason why it should be used unless it carried some police power with it. Our vigilantes are not empowered to make any arrests, except that we have a few men sworn in who have police powers on the streets. Therefore, we figure that the badge is not necessary and that the credential card signed by the chief of police is ample authority if it is found necessary to stop the violator and talk to him on the street.

Our committee is very active. We have night-riding squads as we call them, who go out and clean up on some certain violation, and our committee at the present time numbers about 350 and we are getting 4,500 to 5,000 reports a month, all of which go to the chief of police. He sends a letter or a postal card over his own signature to every violator. Certain classes of violators are required to appear before him. We have been making quite a drive there on the passing of street cars to the left on anything but a one-way street and also passing cars that are discharging or loading passengers. Those violators have to appear before the chief of police and make some satisfactory explanation.

We hold meetings, not every month, but we do get out a monthly report to every member of the committee, showing the number of violations that every vigilante has reported during the month. We have found that the vigilantes take more interest if we keep them informed as to what work is being done.

VIGILANTE TAGS VS. SECRECY

Some mention was made a minute ago about the vigilantes having a special tag or badge on their machines. That has been thought of in connection with our work and personally I don't think it is a good plan. I believe that the best work of the vigilante can be done if it is carried on under the secret service method. If a man is inclined to be a violator and he sees a machine ahead of him or looks around and sees a machine coming behind him with a vigilante badge on, he is going to behave himself, whereas, if he does not know who is behind him, he is more inclined to walk the straight and narrow path.

MR. TOWNSEND: All of our men at the present time are special traffic policemen with full authority to arrest, and most of them also are deputy sheriffs so they are able to get outside of the city and do work on the country roads. One feature that we have different from anything that I have heard mentioned in the other councils is that of weekly meetings. Our men have a luncheon every week and the majority of them attend those luncheons. The chief of police frequently attends. The city manager is a frequent visitor at those noon luncheons. We get the prosecuting attorney of the county in from time to time. They discuss traffic problems in those meetings, and every fellow goes out from the noon meeting full of enthusiasm for service and determined that he is going to try to do good work.

Another little different feature of our organization is the fact that we

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have a captain over the special officers with three lieutenants. The group is divided into three squads, each under its lieutenant, and in the giving out of special assignments the lieutenant handles his own squad and notifies his own squad. This simplifies the matter of handling the squad for special work.

We are receiving a good many reports sent in on the blanks provided for that purpose, but the majority of the cases are handled by the special officers on the spot. They speed up and stop the offender and caution him, talk with him, try to make a friend of safety out of him and if he proves obstreperous, they make an appointment with him in the police court the next morning and then they are ready to swear out the complaint.

SPECTACULAR NIGHT CLEANUP OF AUTO LAW VIOLATORS

MR. MCCLAIN: My experience was in Cincinnati. We instituted our vigilance committee along the regular specifications, and we were doing some good, but the facilities of the police department were inadequate for apprehending violators. So we went to the chief and said we would like to have him assign about twelve plain clothes officers to us on a certain night. We would supply them with high-powered cars and clean up the city. He consented.

They reported to me. We had about twelve cars, all furnished by automobile dealers, who were very pleased to have an opportunity to demonstrate their cars. As a result, the police court the next Monday was pretty full and we had a regular party. Newspaper men were there and the safety council received a lot of favorable publicity.

That feature of the vigilante work is the most helpful. People would say, "Well, you can't tell when these fellows are going to break loose. They may be out any night."

MR. SMITH: I will ask Maj. Haven to give us a talk on what he has accomplished in eliminating glaring headlights.

MINNEAPOLIS HEADLIGHT FOCUSING STATION BRINGS SAFETY AND DOLLARS

MAJ. HAVEN: I will not attempt to tell you the results, because we really haven't had results yet, I might outline in a few words what we are attempting to do. In considering this matter we had three points in mind: first, the elimination of the glaring headlight, which as we all know is responsible for a great many accidents; the second was to help in the unemployment situation, and third, to provide a source of income and revenue for our council.

A short time ago, a lens manufacturer came to me and said that they were going to use a large number of focusing screens in our city. In the first place, he told me that there was a regular focus for every different make of headlight and that any lens that did not have the proper focus was dangerous. While he talked to me I was turning the matter over in my mind and I thought here was a good opportunity to help in the elimination of glaring headlights as a safety measure, and also to provide some money for our unemployed, and also for our local council.

After turning the matter over in my mind I laid it before our finance

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committee and they thought very well of it. As a result we have today down in the heart of the city of Minneapolis a main focusing station with ten screens. These screens are being manned by twenty ex-service men. That is, we have teamed them up so that we can give a large number of men the experience. As we have between forty and sixty thousand automobiles in Minneapolis, you can easily see that it would be a big job to focus the lights the first time, so that as soon as these men learn to do the work under the supervision of experts, we send them out to the outlying districts. The screens will be placed at the filling stations of a local concern, which was chosen because of the fact that any of the other oil companies, like the Standard Oil, would probably have to go to their headquarters and get a permit to do this work, and we had to do it quickly.

We are paying these ex-service men seventy-five cents an hour for three hours' work in the evening. We are charging the members or people who have the lights focused a dollar and a half a year. We have issued a card, a membership card, which says, "$1.50 membership card, Minneapolis Division, National Safety Council, Minneapolis, Minnesota. This is to certify that the undersigned has voluntarily" (we put the word "voluntarily" in there because of the fact that somebody might say, and they did say, that the police department was driving them to our council, but we have announced in the papers that this is not compulsory, that we are simply providing a means for the public to have their lights focused before the police department put on the drive) "paid $1.50 which entitles him to membership in the Minneapolis Division of the National Safety Council for one year from October 1, 1921, and to six service inspections of his automobile headlights during his membership." The license number and owner's signature appear at the bottom.

On the back of the membership card is this: "By becoming a member of the Minneapolis Division of the National Safety Council I have agreed to do my part in reducing accidents and where possible assist in making Minneapolis a safe city in which to live. This membership was purchased in the interest of safety for myself and others, and for its service value."

Below that we have a note to "have headlights inspected: first, after an accident where they would be thrown out of adjustment; second, when bulbs are changed, whenever you change your bulbs, you change your focus; third, when headlights are tampered with; fourth, every two months, just as a general proposition. Warning—thirty-two candlepower legal limit on bulbs."

In Minneapolis thirty-two candlepower is the limit. Around the edge of the card we have the names of the months to be punched when the holder comes in.

Mr. Stewart (St. Louis): Is there a department of the city for testing headlights?

Maj. Haven: We have an official testing station which is used only when there is a question as to whether or not a man's headlight is within the law.

Mr. William W. Rumsey (Bureau of Illumination, City of Milwaukee):

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In this central station, have you facilities for determining the candlepower admitted?

MAJ. HAVEN: That is a thing we have not come to although the people have told us that they will have screens within a few days that will give the candlepower which would be registered right on the screen the same as you folks are using in Milwaukee.

REGULATION OF HEADLIGHTS IN MILWAUKEE

MR. RUMSEY: This Milwaukee proposition originated through the Safety Division of the Milwaukee Chamber of Commerce. We had an old law there that if your lights were glaring you were subject to a fine, etc. We had no means of determining whether they were.

When the law was passed about a year and a half ago, that state law was adopted as a part of the city ordinance, which requires that there be so many candlepower, so many inches from the globe base, so many feet to the right, so many feet to the left.

We designed and have in operation a photometric screen whereby we determine the candlepower of the lamp that is admitted, whether it is above or below the glare line or the point as determined by the law, and this is built on a screen on a track. We have three ways on our floor with guides. We back the automobile in and the room lights are turned out and the automobile lights are turned on and by one look at this screen you can see all things at once. You can see whether there is any glare. You can see whether he has too much road light, not enough road light, too much sidelight, or what is wrong, if anything. That is all done at one look. When this is through, that screen is moved to the second stall and the third, and so on.

The way that is reported is this: the motorcycle officer has three cards that are fastened together, perforated in between. If in his judgment your lights do not comply with the law, he stops you and gets your car number, name, etc., and tells you to go to the central station and find out what is wrong. That driver is supposed to report inside of twenty-four hours.

We have about twelve stations that are certified to the department as being equipped to make these adjustments. We simply turn him loose and he is at liberty to go wherever he pleases and have the adjustments made and report back to this testing station inside of two days. Otherwise he goes to court.

MUSHROOM TRAFFIC LIGHTS

It seems that it would be well to have a paper on hazards caused by traffic posts or traffic devices, because we have gone into this matter very thoroughly and we find that better than 80 per cent of the accidents are caused at intersections. We have accumulated some very interesting data. The expense of accidents of this nature inspired us to try to develop something that would eliminate the hazard to some extent, and we tried out various devices and finally hit upon the mushroom type of traffic light. On one corner the expense to the city was $1,658 in eighteen months in replacing posts destroyed in accidents. With a mushroom

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light on the same corner, in the same length of time, we have spent $27 for a broken dome in the unit. That is the difference between the two types of signals on the same corner.

MR. DEARMAND: Now, in connection with these mushrooms lights—in my opinion, they are the best thing that has ever been put out for boulevards and street railway crossings. We use green globes. Red globes should not be used in my opinion on any intersection where a man passes the mushroom. It teaches a man to pass a red light and he should never be taught to drive past a red light. Our cost is $1 a month per mushroom and we have increased our candlepower by putting in four lights instead of the two that are supplied with the equipment.

COLOR STANDARDIZATION FOR TRAFFIC LIGHTS

MR. RUMSEY: Isn't it also possible to standardize on the color of the lights? If you have a green light, let's have it the same in Maine as we do in California, and let's have it mean the same thing in Maine, so that when I drive through your city I will know just exactly what to do.

MR. SMITH: Last year at the Congress we had a splendid discussion on the proper light, whether it be green or red or yellow, and we had a dozen traffic officers who discussed that proposition. We appointed a special committee, but we didn't get very far. This year we will get these things in definite shape so that we can have reports come in and then next year after the congress we will be able to publish in pamphlet form the results of our work for this year.

LEFT HAND TURNS

Mr. McClain brought up at this point the subject of left hand turns at street intersections. In Louisville, Mr. McClain said, motorists are required to make the turn before reaching the center of the street intersection, and he asked for the sense of the meeting as to whether this was an inferior system to the more common one of having vehicles make the turn beyond the center of the intersection. After considerable discussion, on motion of Mr. DeArmand, the members present unanimously adopted it as their opinion "that left turns on every corner (except where it is deemed advisable by the local authorities to have a special rule made) should be made beyond the center of the street intersection."

MR. SMITH: We would like to have read into this record something about what has been accomplished. Has this public safety idea been worth while? Has it cost us too much money to carry it on? What has been the permanent result of this effort, of getting these ten thousand men and women who drive motor vehicles to subscribe to a membership in your council? Are we going to continue this experiment by having a committee appointed to analyze it and make a survey the coming year with the idea perhaps of getting out a pamphlet on the best method to pursue this idea?

SAFE DRIVERS' CLUBS

While I am on my feet I will say for St. Louis that we followed Charley Anderson's experience in Milwaukee and sent out a letter on safe

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drivers' club stationery, elected officers and asked about forty thousand motorists to join the safe drivers' club. From a publicity standpoint, the name is a winner. Any publicity man will say that carries a headline immediately, a good story, and it has been proved so.

We carried it out by sending this letter attaching the membership card with a few rules on the back as to what the member was expected to do, and a sticker for the windshield of the automobile, and a little pamphlet in their letters outlining the public safety activities of St. Louis. We sent this letter to about forty thousand people, and we got back about five thousand dollars, or five thousand memberships. We didn't go any further. We found that the cost of securing memberships amounted to possibly 40 per cent of the dollar, so we had 60 per cent of this dollar left to carry on activities. Our executive committee has indicated their interest in the idea from this standpoint: that it does enroll in the council a large individual membership. However, I do not think it is going to be permanent. By that I do not mean that all the five thousand members who subscribed last year will not subscribe this year. However, if we solicit others along with these five thousand, we will probably get a lot of new ones to subscribe because there are a lot of new motor vehicle drivers in the city. The reason those who subscribed last year to a membership will not subscribe again this year is that we have not been able to keep up a personal contact in one form or another with these members the past year. They know nothing about what the Safe Drivers' Club has been doing except what they read in the press.

MR. FARIES: What work do you do in that club that you couldn't otherwise have done?

CHAIRMAN SMITH: The outstanding purpose of the club was to rally support around the safe drivers' school, which we conducted. We lined up certain individual companies who were operating large fleets of vehicles through that membership. We also enrolled the postoffice department in our school. We had a ninety per cent registration from the drivers of mail delivery trucks in St. Louis. The school put that over.

MR. FARIES: You use the money from your safe drivers' club to conduct your chauffeurs' school?

CHAIRMAN SMITH: We did, among other things.

MR. STEWART: Mr. Smith is gradually accumulating a mailing list in St. Louis that is going to be very valuable to us which has been secured not only through safe drivers' club, but various schools; and eventually we are going to be able to cover the city individually with the propaganda work which we are mailing out to these different individuals.

MR. ANDERSON: In Milwaukee, we feel that the safe drivers' club is a permanent institution.

MR. SMITH: You have had two years of it.

MR. ANDERSON: Yes. The second drive was not as good as the first. We didn't follow it, because we didn't have the force to follow it up. We secured about nine thousand members the first year, and seventy-eight hundred the second year, at a dollar apiece. Our budget is so arranged that all of our public safety work would be carried on under the safe drivers' club, or through the finance coming from that source. One of

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the greatest campaigns that you can put on with the motorists is a membership campaign in a safe drivers' club. If you got only such members to pay your expenses, I think, you would do a good work. It cost us approximately seventeen hundred dollars to put on the campaign this year. We had something like four or five hundred people soliciting their friends to become members in the safe drivers' club, and that is the way we got the membership this time.

Our scheme wasn't as successful at it should have been. We didn't have a complete system in our office or records of the various concerns, and the plants throughout Milwaukee's manufacturing zone, as we will have within the next two months. We have two committees now working, one a survey committee and one a zoning committee, so that next year we will be able to say, "John Jones is the livest man in Ward 10, Precinct 6. We will turn over to him a definite section, which will comprise maybe ten plants and he will handle it for us." He will be our membership captain in that section; and carrying it out along those lines, I feel quite sure that next year we ought to get a membership of ten, and possibly twelve, or fifteen thousand.

Out of about $7,000, we have already spent say $2,000. That leaves us $5,000 for operation and administration. That money is intended first, for a little magazine that we get out each month, known as *The Greater Milwaukee Safety News*. That costs us about $60 a month. In our budget we have $1,075 for our school work which comes out of the safe drivers' club. Our drivers' school costs us about three hundred dollars, I believe, because we gave each driver (and we graduated 261), an emblem saying, "1921 Drivers' School Award."

We have the vigilance committee, and the cost of that committee will run for this calendar year something like $600 or $700. That comes out of the safe drivers' club fund.

If it is properly organized your safe drivers' club is the best bet you have got, not altogether from the financial standpoint, but as a propaganda organization.

MR. TOWNSEND: Financially, the safe drivers' club in Grand Rapids was not a success. We have a smaller city, about 137,000. We circularized 16,000 drivers in our campaign. The drive cost us about an even $1,200. We have 1,100 members. Financially, we were about one hundred dollars in the hole on the campaign; yet we have the firm conviction that it has been a success. The advertising value has been worth the effort and many times over. We have tried to keep in touch with that membership of 1,100, during the year. We have sent out four general letters to them with information on any traffic law changes—anything of interest along those lines. It won't cost us nearly as much this year for we are expecting to do our work pretty largely through the present membership. I think that we shall offer a free membership for every five that are sent in. I think a lot of those fellows aim to send in the names of four or five others besides themselves and get their free membership.

CHAIRMAN SMITH: Do you plan to ask them to collect the money and send it in?

MR. TOWNSEND: Yes.

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MR. ANDERSON: I think it is very important to keep in touch with members, but if we send out four or five letters to a membership of eight or nine thousand, we would soon eat up our finances in postage. We are working on that plan now. We are going to reach our membership within the next month, with something definite as to what the safe drivers' club has done, the financial end of it and what we expect to do in the future.

We have been very active through our traffic committee, of which Mr. Rumsey here is a member, and have finally gotten the boulevard stop system in ordinance form to the common council. If that goes through, and I am sure it will in the next few months, 90 per cent of the motorists of Milwaukee will say the safe drivers' club is a wonderful organization. They are waiting to see whether we are going to do it.

MAJ. HAVEN: In Minneapolis we are thoroughly sold on the safe drivers' club idea. As a matter of fact, we went into it very thoroughly. I got all the information I could from every source. The expense involved scares us. Our council, like a good many others, is having a hard time in getting along financially, but we feel with this scheme that we have of focusing headlights we are going to get just what Mr. Stewart mentioned a moment ago, the names and addresses of possibly fifteen or twenty thousand of the fifty or sixty thousand automobile drivers in Minneapolis.

We hope with that list of names, and the revenue attending the getting of it, we will be able to go into this thing with less expense. I want to emphasize the value of anything you undertake whereby you get a man's name and address as an automobile driver. I think that it will warrant almost any expense within reason to get a list of those people, because once you have them then you can do almost anything you please with them.

MR. T. A. WALSH (Delaware Safety Council, Wilmington): The Delaware Council gets the monthly publication of the list from the secretary of state of every automobile owner in the state of Delaware. We make our list from that.

CHAIRMAN SMITH: I think it has been demonstrated by these three experiences that we should continue our efforts along this line—at least it is worth while from the standpoint of propaganda, if not from the financial standpoint.

MR. ANDERSON: We have a ten dollar contributing membership and we have something like two hundred of those.

CHAIRMAN SMITH: We have a plan under way now, where we are going to start a public safety section of our council in St. Louis, where we have active members who will pay anywhere from ten to one hundred dollars to the safe drivers' club membership. Then we have the pedestrians' club. It is just as important to walk right as it is to drive right. That membership will be absorbed into the membership of the St. Louis Safety Council. In other words, they will be members of the council, not of any particular subdivision.

MR. CLARKSON: We are tying up our safe drivers' club with the chauf-

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feurs' school. In other words, we want to put on another chauffeurs' school, and we are organizing it in connection with the safe drivers' club. We plan to charge a membership fee of ten dollars and one dollar per automobile to the owner who has a large number of cars.

WORK OF PUBLIC SAFETY SECTION FOR ENSUING YEAR

CHAIRMAN VAN SCHAACK: I think that completes the order of proceedings. I would like to ask not only the cordial but active co-operation of you all in making this year of the Public Safety Section, a real red-letter one. Public safety has come to the front so much now in the minds of the people that they are going to look somewhere for the right place to start and carry on public safety; and I don't know of any better place than here, where the section includes in its membership all of you men who have been trying these different experiments, and are gradually tending toward standardization.

Now membership on these committees, (the official membership) is not going to be a sinecure this year, because it is going to give me great pleasure pretty soon to suggest a few things for the consideration of the committees, and we expect real work from them. We are planning to hold quarterly meetings of this section, quarterly meetings at the same time as the executive meetings of the National Safety Council, and at the same place. There will be invited to those quarterly meetings the chairman, the vice-chairman and the secretary of each of the committees of the Public Safety Section. We think in that way we can spread abroad much more quickly those things which are found advisable than if we wait till the end of the year.

I want to urge you all to attend all these quarterly meetings, of which you will be notified in due season, and in order to transact as much business as possible we are going to ask you to send in the names of certain subjects which you desire to discuss, in advance of the meetings. Those subjects will be put into shape and will be sent out to all the others, with the request that each one of them, if he has a contribution to make, have it in shape so that it can be presented concisely.

ADJOURNMENT.

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Public Utilities Section

September 27 and 28, 1921

C. E. MORRISON, Chairman
Vice-President, Utilities Mutual Insurance Company, New York City

J. F. NAYLON, Vice-Chairman
New York Telephone Company, Newark, N. J.

J. J. O'CONNOR, Secretary
People's Gas Light and Coke Company, Chicago

IN ATTENDANCE AT THE PUBLIC UTILITIES SECTION MEETINGS

ARTHUR H. ABBOT (Manufacturers' Agent, High Voltage Equipment)—
Arthur H. Abbot, Boston.
ALABAMA POWER COMPANY—
W. R. Loyd, Birmingham, Ala.
AMERICAN ENGINEERING STANDARDS COMMITTEE—
P. G. Agnew, New York City.
AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS—
Wm. McClellan, New York City.
AMERICAN TELEPHONE AND TELEGRAPH COMPANY—
W. P. Elstun, New York City.
BELL TELEPHONE COMPANY OF PENNSYLVANIA—
A. B. Detwiler, Philadelphia.
M. L. Lafferty, Philadelphia.
Jno. Bailey, Philadelphia.
BLACKSTONE VALLEY GAS AND ELECTRIC COMPANY—
Harry Burnham, Pawtucket, R. I.
Warren Haskell, Pawtucket, R. I.
P. F. Hodgkins, Pawtucket, R. I.
E. E. Nelson, Pawtucket, R. I.
Gardner Rogers, Pawtucket, R. I.
W. L. Cheney, Woonsocket, R. I.
A. L. Cole, Woonsocket, R. I.
Wm. L. Curtis, Woonsocket, R. I.
J. G. Fitzgerald, Woonsocket, R. I.
J. M. Hawes, Woonsocket, R. I.
E. L. Milliken, Woonsocket, R. I.
F. K. Simmons, Woonsocket, R. I.
BOSTON ELEVATED RAILWAY COMPANY—
Matthew J. Curtin, South Boston, Mass.
G. M. Tompson, Jr., Charlestown, Mass.
BUFFALO GENERAL ELECTRIC COMPANY—
J. C. Van Vleet, Buffalo, N, Y.
BUREAU OF SAFETY—
Samuel H. Reid, Chicago.
Charles B. Scott, Chicago.
CHATTANOOGA RAILWAY AND LIGHT COMPANY—
H. B. Whiteman, Chattanooga, Tenn.
COMMONWEALTH EDISON COMPANY—
C. H. Davis, Chicago.
A. B. Gates, Chicago.
Homer E. Niesz, Chicago.
CONNECTICUT LIGHT AND POWER COMPANY—
C. A. Penrose, Waterbury, Conn.

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Consolidated Gas Company of New Jersey—
Harold E. Mason, Long Branch, N. J.
C. D. Snyder, Long Branch, N. J.
Detroit Edison Company—
George Opp, Detroit.
Eastern Land Company—
William D. Lancaster, Boston.
Eastern Massachusetts Electric Company—
A. T. Throop, Salem, Mass.
H. G. Jenks, Salem, Mass.
Edison Electric Illuminating Company of Boston—
K. E. Adams, Boston.
O. B. Benson, Boston.
Samuel C. Clough, Boston.
William A. Coolidge, Boston.
L. D. Gibbs, Boston.
Herbert W. Moses, Boston.
Charles A. Rick, Boston.
W. G. Small, Brockton, Mass.
Daniel O'Neil, South Boston, Mass.
Frank W. Philbrick, Quincy, Mass.
Frank R. Chase, Somerville, Mass.
Electrical World (New England Edition)—
Howard S. Knowlton, Cambridge, Mass.
Electric Light and Power Company of Abington and Rockland—
Geo. W. N. Clark, Rockland, Mass.
George E. Philbrick, North Abington, Mass.
Arthur H. Robbins, North Abington, Mass.
Empire Gas and Electric Company—
E. R. Dobbin, Geneva, N. Y.
Fall River Electric Light Company—
D. S. Owler, Fall River, Mass.
Howard A. Stanley, Fall River, Mass.
Fitchburg Gas and Electric Light Company—
A. G. Neal, Fitchburg, Mass.
Frank D. Powers, Fitchburg, Mass.
Edward B. Ryan, Fitchburg, Mass.
W. E. Vandell, Fitchburg, Mass.
General Electric Company—
A. T. Comstock, Lynn, Mass.
J. A. Dalzell, Lynn, Mass.
Z. N. Lord, Lynn, Mass.
Haverhill Gas Light Company—
William Bell, Haverhill, Mass.
Joseph H. Cook, Haverhill, Mass.
George Jones, Haverhill, Mass.
W. J. LeBlanc, Haverhill, Mass.
G. E. McCaffrey, Haverhill, Mass.
Timothy Moynihan, Haverhill, Mass.
John W. Murphy, Haverhill, Mass.
John J. Neagle, Haverhill, Mass.
Tom P. Walker, Haverhill, Mass.
Illinois Bell Telephone Company—
H. M. Webber, Chicago.
Industrial Accident Prevention Association—
R. B. Morley, Toronto, Ont., Canada
International Harvester Company—
W. E. Worth, Chicago.
Keyes, John T. (Insurance Broker)—
John T. Keyes, Dorchester, Mass.
Laclede Gas Light Company—
C. Howard Stewart, St. Louis.
Liberty Mutual Insurance Company—
S. E. Whiting, Boston.
Lynn Gas and Electric Company—
Robert B. Buxton, Lynn, Mass.
John H. Curtin, Lynn, Mass.
Harold M. Lamper, Lynn, Mass.
G. C. Nichols, Lynn, Mass.
Ovan A. Patten, Lynn, Mass.
F. J. Phillips, Lynn, Mass.
R. E. Roberts, Lynn, Mass.
W. H. Varney, Lynn, Mass.
Malden and Melrose Gas Light Company—
R. S. Carter, Malden, Mass.
Maclachlan, Wills (Consulting Engineer)—
Wills Maclachlan, Toronto, Ont., Canada.

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New Bedford Gas and Electric Light Company—
Robert Lindsay, New Bedford, Mass.
New England Power Company—
W. S. Cavanaugh, Worcester, Mass.
H. F. Lovering, Worcester, Mass.
P. L. Paterson, Worcester, Mass.
New England Telephone and Telegraph Company—
Luke E. Dean, Springfield, Mass.
W. F. Gowdey, Springfield, Mass.
Walter T. Hannigan, Boston.
D. R. Hawley, Boston.
H. A. McCoy, Boston.
F. E. Tarr, Boston.
C. N. Tasker, Springfield, Mass.
New York Edison Company—
Wm. Darlington, New York City.
New York and Queens Electric Light and Power Company—
W. P. Strickland. Long Island City, N. Y.
New York Telephone Company—
F. M. Downey, Newark, .N J.
J. F. Naylon. Newark, N. J.
Northern Indiana Gas and Electric Company—
A. O. Mitchell, Hammond, Ind.
Pennsylvania Water and Power Company—
Alexander E. Bauhan, Baltimore.
Peoples Gas Light and Coke Company—
Ernest S. Beaumont, Chicago.
Philadelphia Electric Company—
B. Frank Day, Philadelphia.
H. B. Harmer, Philadelphia.
H. C. Lucas, Philadelphia.
Pittsburgh Railways Company (Duquesne Light Company)—
C. G. Rice, Pittsburgh.
Providence Gas Company—
C. P. Buddenhagen, Providence, R. I.
Public Service Company of Northern Illinois—
Hugh A. Ptolemy, Chicago.
Rochester Gas and Electric Corporation—
F. W. Fisher, Rochester, N. Y.
Salem Electric Lighting Company—
William H. Barnard, Salem, Mass.
Harry A. Cook, Salem, Mass.
H. Kingsley, Salem, Mass.
William P. Verry, Salem, Mass.
Shawinigan Water and Power Company—
Eugene Vinet, Montreal, Canada.
Standard Safety Equipment Company—
A. U. Barnes, Newark, N. J.
C. A. Kingsbury, Chicago.
Stone and Webster, Inc.—
R. E. Argersinger, Boston.
W. B. Hopkins, Boston.
R. A. Hopkins, Boston.
P. Junkersfeld, Boston.
M. J. Lowenberg, Boston.
W. R. McCann, Boston.
L. O. Waite, Boston.
R. R. Wisner, Boston.
Harry R. Woodrow, Boston.
Syracuse Lighting Company—
John J. McGraw, Syracuse, N. Y.
The Texas Company—
A. B. Cox, New York City.
The Travelers Insurance Company—
Alfred A. Beckwith, Hartford, Conn.
United Electric Light and Power Company—
Edward W. Gorry, New York City.
United Gas Improvement Company—
James F. Conner, Philadelphia.
James B. Douglas, Philadelphia.
R. Burdette Inman, Philadelphia.
United States Bureau of Standards—
M. G. Lloyd, Washington, D. C.
Utica Gas and Electric Company—
W. J. Duffy, Utica, N. Y.

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UTILITIES MUTUAL INSURANCE COMPANY—
R. A. Bloomsburg, New York City.
Charles E. Morrison, New York City.
G. R. Rinke, New York City.
F. B. Van Doren, New York City.
WESTCHESTER LIGHTING COMPANY—
W. L. Brux, Mt. Vernon, N. Y.
WORCESTER GAS LIGHT COMPANY—
Thomas H. Clark, Worcester, Mass.
G. M. Hardy, Worcester, Mass.
George L. Simmonds, Worcester, Mass.
Arthur F. Snow, Worcester, Mass.

TUESDAY MORNING SESSION

THE meeting was called to order by Chairman Morrison at 10 a. m. The reports of the officers and committee chairmen were presented and unanimously accepted.

CHAIRMAN MORRISON: The first speaker will be Mr. Scott.

THE NECESSITY OF THE SUPPORT OF EXECUTIVES IN ACCIDENT PREVENTION WORK

CHARLES B. SCOTT, GENERAL MANAGER, BUREAU OF SAFETY, CHICAGO

(*With Apologies to George Ade*)

Mr. John Doe familiarly was known as Johnnie to nearly all the citizens of Hickville. In addition to Johnnie's extensive acquaintance he was possessed of more or less but waning political influence within the thriving home town. He was the recent victim of that characteristic misfortune—so common to local political good guys—the political complexion of the municipal administration had suddently and unexpectedly changed from the brilliant red of his favorite party to the somber tone of the old enemy and he was out of a job. Johnnie's more or less hectic income, from deputy this and deputy that, had ceased and he didn't have a look in at the old pie counter in the city hall. Not only were the semi-regular and persistently sought iron men denied him, but worse than that, his local credit was at low ebb because his bankers (political associates) were also victims of this recent catastrophe. All that was left from the cyclonic upheaval so far as Johnnie was concerned, were old friends, his own gracious mannerism, his lifelong aversion to manual labor, his abhorrence of that sticky feeling which comes from perspiration and his pass on the street car. The future was full of little glooms and big glooms, the old political field looked barren, for women were sowing and harvesting in the field, and modern election machinery did not even leave enough loose grains for sustenance to such as he.

Johnnie had done many good turns in the old prosperous days and thereby had he established that local prestige which had been his halo and his good angel. When he represented the seventh ward in the city council back in the nineties, he had fathered and put through the existing franchise for the Hickville Gas, Electric and Railway Company, and like Policemen O'Brien, whose appointment he secured, the vice-presi-

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dent and general manager of the Hickville Gas, Electric and Railway Company was under some obligation to Mr. Doe for this franchise and subsequent but smaller favors. Of course he was under obligation, for all friend Doe had ever received for his services during the franchise getting days were a few boxes of cheap cigars and his treasured street car pass.

We now turn our attention to Mr. J. Wallingford Givney, vice-president and general manager of the Hickville Gas, Electric and Railway Company. Clothed in garments with straight lines and a reputation, said reputation registering 32 degrees Fahrenheit winter and summer, 'tis said of J. Wallingford that he once fell on the ice pick while making himself a solitary highball and though the pick penetrated his clammy anatomy for one and one-fourth inches, not a drop of blood was shed and only the pale purple hole evidenced his misfortunes. Whatever might have been truthfully said derogatory to the humaneness of J. W., there was not one among his fellow vestrymen, his pinochle club, or his aggregation of H. G. E. & R. chain gang, but who took off his hat in acknowledgement of J. W.'s prowess when it came to getting a strangle hold on the American Bird pictured on the coins of the realm. Ice water and lavatories were as taboo in the general offices as were hope and happiness in the working force, and the most conspicuous things about the dismal hive were fear and time clocks. The monthly bills sent out to patrons, the street car tickets, the Ford trucks, the countenance of J. W., and the poles of the company all bore the announcement, "Service First" and all except the countenance of J. W. bore them in uniform and stencilled letters.

J. W. had many momentous questions to solve even after Doe put over the franchise. Times were changing—they should not change but they did. Automobiles were coming into general use to harass the street car operation, machinery was wearing out, lines were deteriorating, and worst of all, net earnings were becoming so small that dividends were not only difficult but surely would be soon impossible. Accident costs had always had a place on the printed balance sheet form, it was the third item under Expenses. J. W. had it printed there eighteen years ago. He said at the time, "It's a permanent expense for as long as such properties are maintained and operated, just so long will accidents occur." It was because of this permanency and sureness of this expenditure that J. W., though sorely tried to find a place into which to wield his good axe, had never thought of driving this deadly weapon into this third item. He had, however, brought the overworked claim agent onto the green carpet several times and together they had worked out economies in office and investigation expenses which if they materialized, might possibly reduce the obnoxious item on the monthly balance sheet from sixteen thousand by nearly five hundred dollars.

It was at one of these green carpet seances that an event occurred which brought Johnnie Doe into his first regular employment at a real job. The assistant claim agent had resigned when his pay was cut from $125 per month to $110, and Johnnie's application received unexpected and favorable consideration, and in a few days Johnnie appeared with new rubber heels on his shoes, new hope in his heart, and assumed a long

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coveted berth in J. W.'s cold storage institution surrounded by other frozen fish.

THE BIRTH OF "SAFETY FIRST"

Within three short months, during which Johnnie had worn out his second set of rubber heels in order to escape the frigid atmosphere of the office, he had become the shining light and glad hand artist of the company's organization, and while claim costs had unfortunately reached an unprecedented high peak, the claim agent had gained three pounds and confidence in Johnnie's assistance. The claim agent often sought the sunshine of Johnnie's personality, and one eventful evening Johnnie gave him an earful of dope about starting a safety first campaign in line with the publicity then being given a neighboring public utility by the local press. The upshot of the conversation was that Johnnie extracted some perfectly good money from his expense account and forwarded it to the National Safety Council in Chicago and received regularly thereafter certain attractive pictures of wrecks, maimed hands, etc., from Fred Rosseland. When Johnnie exhibited these to his chief, the claim agent, they cried with one accord, "That's the stuff," and thus was born the Safety First Campaign of the H. G. E. & R. The new youngster, Safety First, was a noisy kid and as florid as its father Johnnie, blasé, versatile, with an appetite for cheap cigars, sandwiches and soda pop. It was soon arrayed with buttons bearing its name and had a mania for playing with red fire and sky rockets. Johnnie didn't have to give the kid much attention, for from the very beginning it seemed to be able to take care of itself and to thrive. Johnnie introduced it to all his friends in the organization and once at a presentation carnival became so fired up with his introductory remarks that both he and the claim agent cried because of their sentimental concern for his offspring.

In honor of the child Johnnie posted Mr. Rosseland's bulletins on all the windows and on the Ford trucks, thus popularizing the new kid and heralding the information of its unquestioned and proud fatherhood.

"SAFETY FIRST" LANGUISHES

In the month of July of the first summer succeeding the birth of Safety First, the child became ill. Rapid deterioration, atrophy, loss of appetite and disinterest were the outstanding symptoms. Johnnie administered goodly portions of literature, statistics and buttons and massaged it with his personal touch but without any noticeable improvement. One day when the weather and the general superintendent were sweltering hot, when the child was lonesome and sick, the general superintendent in characteristic Dawes fashion and in the presence of employees, told Safety First to go to hell. Johnnie, with proper parental solicitude for his ill but perfectly respectable child, chose the other extreme of accessible temperature and with his chief carried the poor, sick, shocked baby to J. W., seeking counsel in the interest of its vital requirements. J. W. was at the moment deeply concerned about the health of his own children. "Finance" was peevish and hungry; "Operation," another favorite

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child, had recent evidences of anemia and laziness; "Construction" was bedridden, and others of the family were none too well.

"I have troubles of my own and in my own household," said J. W. "My company hospital is full and my coterie of regular attendants are overworked. We have no time for benevolent service to outside patients and besides Safety First is an industrial non-essential."

Just then the choleric general superintendent joined the group of mourners and the row was on.

Johnnie wrote a letter to Dr. C. W. Price, Specialist, of Chicago, and received the following reply:

"Dear Brother:

"The very first requisite for success and permanency of accident prevention efforts in any industry is the whole-hearted support of the chief executive. It is impossible to maintain the interest of supervisory forces in an activity which the management does not consider essential to the success of the business. Our experience during the existence of the Nation Safety Council proves beyond doubt that in every instance when executive support has been given to accident prevention, accidents and accident costs have been reduced. Safety of operation is an essential in any industry and particularly in the public utility business where rigid economies are so necessary and where the public is so much concerned because its own safety is involved. If there is any one business where safety work should be dignified and given its proper standing among other company activities, it is most certainly in such public service companies. Claims and claim costs growing out of personal injuries are absorbing the net revenue of many public service properties—some are paying hundreds of thousands of dollars each year for accidents but will not spend a few thousand for prevention. Why the management of these companies takes such a stand is beyond my comprehension.

"However such executives as these and your own Vice-President Givney are in a very small minority and a rapidly decreasing one. The public service industry as a whole has assumed a high position among the industries for its successful accident prevention work. To many of the well managed companies accident costs have ceased to be a burden and with these public relations and employment relations have been greatly improved. The public and the employees of a company quickly respond to any efforts for general good and the confidence so born of whole-hearted safety work are healthful to any community or industry. Your failure on the H. G. E. & R. does not reflect on your own efficiency; no trained expert could have succeeded in such a situation. I can only commend you for your earnest efforts. I regret that I can offer no practical solution of your problem."

The patient lived three days, was buried in the file case, and its soul passed on to the receiver of the H. G. E. & R., who took it over to the industrial morgue shortly afterward.

MORAL—External remedies cannot cure internal diseases.

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SUPPORT OF EXECUTIVES A PREREQUISITE OF SAFETY

The support of executives, if you have in mind the chief executives of the company, is a prerequisite rather than a requisite of safety. In any organization, small, medium or large, public utilities or otherwise, the very first step is securing the active interest, the hearty support, the backing of the chief executives of that company. Subsequently, the efforts of the safety man should be to secure that earnest, heartfelt, and continuing interest in the movement with which he has been charged. If the support of the executives is considered by those in a supervisory force in an industry, then I believe that their co-operation, their sympathy, and their interest may possibly be secured afterwards. I have often thought about these men in subordinate positions, in supervisory capacity, and tried to view the work of accident prevention from their standpoint, and I have looked at it in this way—supposing you are a safety man in the company, and you have a small staff, and suppose some day a man from the operating department of the company should walk into your office and say, "I have been delegated to improve conditions in your force, I believe that by the shifting of your force I can improve your business, and I believe I can tell you how you can do it better than you are doing it now." I am sure there isn't a man here who would sit down and listen. My point is that the man who is charged with getting co-operation in any organization must be a man not like Johnny Doe, but must be a man who has within himself the power and the tact to secure that co-operation. It cannot be done instantaneously, it cannot be done without careful study and planning. I believe that the safety work in public utilities is weakened generally by these two factors: lack of support from the chief executive and lack of tact in getting the support of the subordinates.

DISCUSSION OF MR. SCOTT'S PAPER

H. C. Lucas, Treasurer, Philadelphia Electric Company, Philadelphia

'Tis strange to be asked to present a brief discussion on the paper just read—"The Necessity of the Support of Executives in Accident Prevention Work," for the reason the answer is obvious. There can be no sustained prevention work in any organization that has not the support of "the top."

While it was true executives in many organizations were cold and unsympathetic towards accident prevention efforts in the early days of the movement, before the attention of the thinking men of the world was called to the necessity of doing something which would lessen the daily toll of injuries and fatalities, today, no executive would place any obstacle in the path of accident prevention work, and I think it is not from the selfish standpoint only—the economies of the work having been proved—but largely from the humane standpoint.

The United States Census Bureau recently made public some accident statistics, and they indicate we are becoming less careless as a nation.

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Credit for the decrease in the number of fatal accidents during the twelve months was given to the "Safety First" movement.

There is one class of accidents, however, I wish to particularly mention —*automobile* accidents. True, the increase in automobile accidents does not keep pace with the increase in the number of automobiles. If it did, we would be in despair. Nevertheless, the number of these accidents increases each year, and the careful thought, time and work given to attempting to prevent them, have not produced the results they should. To self-insurers this is serious, and should be equally so to those who insure with the liability companies, as the settlement of these accidents is becoming more costly each year. The automobile insurance companies realize this, and self-preservation demands they raise their rates. With the continued increase in motor accidents where will the increase in rates end?

What is to be done to reduce the number of accidents in this class? As these accidents constitute the most serious problem confronting us, while we cannot entirely eliminate them, they will be minimized when we come to a fuller realization of the fact that it takes two bodies to cause a collision, and the issuing of operators' licenses should be only to persons of physical ability and a moral appreciation of the rights of all. They should demonstrate this by passing suitable examinations, and licenses should be cancelled promptly on the occurrence of so-called "accidents." This would tend to develop careful methods of operating, and selfish and properly named "road swine" would soon disappear. Railroads relieve an engineer from duty with loss of pay, or dismissal, if he has an accident. Why should not all utility companies employ the same methods in their transportation departments? A disregard of the rights of others is a breach of law—so why tolerate it? Continuation in employment should be entirely dependent on freedom from accidents. Let us pay for the safe operation of our vehicles—not for that reckless carelessness that builds up unnecessary damage payments, and destroys the equipment in which we have invested our perfectly good dollars.

"LACK OF EXECUTIVE SUPPORT" OFTEN ONLY AN EXCUSE FOR POOR SAFETY WORK

To return to our text. The so-called lack of executive support is often used as an excuse for the failure of poorly conducted prevention work. There must be a record of good results to interest the executives. Executives cannot devote all of their time to any one branch; it is the duty, therefore, of the safety engineer, or the accident prevention department, to constantly be alive to their many safety problems, but to bring to the attention of the executives only the problems which require special approval and co-operation for carrying on the work.

MR. FISHER: Let us put it this way—most of us are in the accident prevention field rather than the management of the company. Somebody has convinced the chief executive that accident prevention is a good thing and we have tried it out. If we cannot keep up that enthusiasm, and that interest, it is not his fault. As to just how to do it, methods in

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general have been suggested, but it strikes me it is the man himself rather than his methods.

It is all a dove-tailed proposition, the boss is going to ask how the safety man gets along, and if the boys like him, and if the general superintendent says that he is a good scout, let him keep on. There are times you have got to simply swallow your pride a little, and let the recommendations go by the board, because you have got to have the superintendent's co-operation. We have got to deliver the goods, we have got to cut out the accidents and get the superintendents and men all down the line to co-operate with us, because they feel it is their job.

CHAIRMAN MORRISON: I will appoint on the nominating committee Mr. Charles B. Scott, Mr. H. B. Harmer, and Mr. Fred W. Fisher.

MR. DOUGLAS: I have never heard a non-technical paper at a meeting of this section that I believe to be as useful to the public utilities in general as the paper Mr. Scott has read. I believe it would be very helpful to the cause to make special copies of that paper available, not only to the members of our own section, but to members of other sections.

MR. MACLACHLAN: I can say very little on this question except to commend the paper, particularly to the smallest utilities. We are very prone to say we are not getting the support of our executives when possibly we are not looking after the job in the right way ourselves and not putting it across. One great difficulty is keeping the interest, possibly not of the chief executive, but of the superintendent, manager, department heads, and so forth. See that you get your accident statistics into their hands and that you keep the statistics reasonably up to date. I have in mind one utility that is preparing at the present time the accident records of last November.

MR. DOBBIN: I think every one of us realizes the importance of the movement, and with the idea of Safety First going in in the right way, you will get good results. I do not take details of my department work to a chief executive, because I do not feel it necessary, but every time I have a good report to show, I take it there, and I can get there ten times a day.

MR. DOUGLAS: Mr. Dobbin, does your company serve small communities?

MR. DOBBIN: Yes, Mr. Douglas, we serve three or four counties with gas and electricity and have several plants. I find the hardest men to satisfy among the old employees but gradually they get the idea. Personal effort does a great deal and good management is another feature.

MR. DOUGLAS: In our own case, I do not know of a safety department enjoying better support from the main executives so far as the controlling company is concerned, but like Mr. Scott we are interested in a number of small companies around the country in charge of superintendents who do not always regard our accident prevention efforts in the best light. Were Mr. Scott's paper read by them I believe self-examination would result, and they would see the safety effort in its proper light.

MR. LUCAS: Without tact a safety man is not worth a damn. We ought

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to cultivate tact morning, noon and night, because that is the only way you get to the lesser man in the subordinate position.

CHAIRMAN MORRISON: The next paper is by Mr. Bauhan.

HAZARDS IN HYDRO-ELECTRIC PLANTS

ALEXANDER E. BAUHAN, SUPERINTENDENT OF STATIONS, PENNSYLVANIA WATER AND POWER COMPANY, BALTIMORE, MD.

It is the purpose of this paper to discuss the various hazards which are peculiar to the operation and maintenance of hydro-electric plants and the precautions which may be taken to avoid them.

Consideration will be given to the hazards in connection with men reporting on equipment, designation of apparatus, floods, outside structures, flashboards, screens, headgates and wheel pit work.

HOLD-OFF SYSTEM

The principal and most frequent hazard in any power plant is that of men getting on live electrical equipment and that of putting equipment in service with men working on it. To prevent such accidents, well operated plants have in use what is usually called a hold-off system—some kind of a systematized procedure by which the men are reported on apparatus and protected in such a manner that this apparatus cannot be made alive or started.

The hold-off system in use at the Holtwood plant has been the result of careful study and it has been in practical operation for several years and is working out in a highly satisfactory manner. While in its general scheme it is probably similar to that used by other companies, it varies in details, particularly in that it takes care of the mechanical and hydraulic end of the equipment as well as the electrical, which is rather unusual. It covers all apparatus controlled by the operation.

It can be briefly described by an example. Take the case of a man going into a wheel pit for an inspection. The workman goes to the operator and asks to be reported on the turbine, stating briefly what his job is to be. The machine is taken out of service in the usual way, the generator disconnectors are opened and a hold-off sign put up to caution against the closing of these disconnectors. This sign is so designed that it prevents the opening of the door in front of the disconnectors. The generator field knife switch is then opened and a hold-off sign placed on it. This sign is again so designed that the switch cannot be closed without removal of the sign. The headgates are lowered. There are four gates to each unit and a chain to which a sheet iron hold-off sign is attached is run through all four gate stems. The chain serves to delineate the four gates belonging to that unit in case those on either of the adjacent units should be down. In addition the clutch which it is necessary to close before the gate can be raised is locked in the open position. The wicket gates on the turbine are then opened halfway. This is done to permit headgate leakage water to freely pass through the vanes and prevent building up a pressure in

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the wheel pit which might cause rotation of the turbine. The hand wheels used for starting the unit on both the governor and hand control stands are then locked by a chain to which a metal hold-off sign is attached.

The foregoing work is usually done by the assistant operator. The operator then inspects the work and proceeds to test the generator terminals for potential with a test stick. This test stick consists of an insulated wheel metal cylinder on the end of an insulating stick. He then applies the grounds in a prescribed manner at the oil switch terminals. What is known as a ground card is attached to the mimic bus on the switchboard at the point corresponding to that at which the grounds were applied. The number of the hold-off card for which the generator was grounded appears on it. This card simply indicates that the apparatus has been grounded and is removed when the grounds are removed. It serves to prevent accidentally leaving the grounds on the generator when it is restored to service.

The operator then makes out what is called a hold-off card which is a red cardboard tag somewhat larger than an ordinary shipping tag. When filled in this card indicates the name of the man and the apparatus he is reported on, time of reporting on and a brief statement of what work is being done and is signed by the operator. On the back of this card is recorded the location of each hold-off sign which has been placed on the disconnectors, headgates, etc. The card has a detachable stub bearing the same serial number as the card. Similar entries to the above appear on the stub. The workman is then reported on and he is given this stub.

WORKMAN ALSO MAKES INSPECTION AS PRECAUTION FOR HIS OWN SAFETY

The workman before going to work is required to make an inspection of the various precautions which have been taken for his safety. He examines the grounds and goes to each of the hold-off signs. To each sign he attaches what is called a workman's tag. This tag consists of a piece of fiber with his name painted on it and a loop of twine attached to it. The purpose of this tag is twofold; first it systematizes the workman's inspection of his protection; second it makes accidental removal of the hold-off sign, when one man reports clear leaving another one on, less likely. It was suggested particularly by a near accident in connection with some wheel pit work. In this particular case there was a gang of men working in the wheel pit under a foreman who was reported on the unit. The work in the wheel pit had progressed to such a stage that it was necessary to move the vanes for an inspection. The foreman in charge went to the governor attendant and requested him to open and close the vanes, which he proceeded to do. The governor attendant however forgot that an inspector not working under the foreman had been reported on the unit. The inspector at the time was working on the operating engine outside of the wheel pit and could not see what was going on in either the wheel pit or on the main floor where the control apparatus is located. The foreman in charge of the wheel pit work had no knowledge of the inspector being on the unit. The inspector had his body in such a position

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that, had he not immediately extricated himself when he saw the engine piston rod beginning to move, he would have been crushed. The present practice of using the workman's tag makes a recurrence of this trouble unlikely for the reason that when the governor attendant goes to the control stand he would see thereon two workman's tags attached to the hold-off sign on the chain locking the control wheels and would not operate the vanes without warning and getting permission of other man.

When the workman is through with his job and has made the necessary inspections to see that the apparatus is clear as far as his work is concerned, he goes to all the various hold-off signs and removes the workman's tag. He then reports clear to the operator, signing his stub and turning it in. The operator removes the hold-off card, signs it and makes the appropriate entry in the log book. Grounds are removed and the various hold-off signs and locks are removed, provided there are no other men still reported on the apparatus and provided no workman's tags remain attached to any of the hold-off signs. The removal of the hold-off signs is checked on the back of the hold-off card.

In the case of electrical apparatus it is the rule that the operator must be the first man to touch it. This must be done in the presence of the workman at the point where the work is to be done. It is also the practice on electrical equipment never to permit a man to work out of sight of grounds. If the workman is unable to see the regular operator's grounds which have been applied for his protection, he is required to put on grounds of his own. For instance in the case of a transformer, the operator grounds the low tension and high tension terminals at the oil switches. These grounds cannot be seen from the top of the transformer and it is therefore necessary for the workman to apply his own grounds on the high tension terminals of the transformer.

The hold-off system is applied not only to the major apparatus in the station but also to all minor apparatus which may be under the jurisdiction of the operator. It includes the governor piping, lubricating oil system, compressed air system, lighting, control and instrument circuits, electrically operated window mechanism, and in fact everything that is in any way involved in the operation, whether electrical or mechanical. For the purpose of graphically recording where men are reported on about the station on apparatus other than electrical, particularly on the governor piping system, there has been installed a hydraulic mimic board which corresponds to the mimic board on the electrical end. The condition of every valve in the governor system is indicated and the operation of pumps is shown by pilot lights. The hold-off cards for the hydraulic piping equipment are attached to this board.

DESIGNATION OF EQUIPMENT

The operation of a plant requires that orders referring to the various equipment in the plant be given from man to man either in person or over the telephone. In order that the danger of misunderstanding orders may be eliminated, it is advisable to have all equipment in the station officially designated and make it the practice for everybody to use these

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designations. If a man has been in the habit of calling a piece of apparatus by a certain name works with another man who may have been using a different name, confusion, if not accident, may result.

Every piece of equipment in the station, every circuit and every part of the plant should have a name and it should be called by that name by everyone, not only in the operation but in the office and engineering forces of the company. It should appear by that name on all prints. Designations should be posted on a diagram and should appear as far as possible on the apparatus itself in prominent lettering.

In working out a system of designations, simplicity should be kept in mind. Designations should be as short as possible without sacrifice of plainness. The system should be logical and the names easily remembered. As far as possible the designations used should be those which the men naturally and ordinarily make use of. The designation "rotary" is preferable to "synchronous converter" if the men have been in the habit of speaking of the machines as rotaries. "Oil switch" is preferable to "circuit breaker" if the word oil switch has been more used by the men. The designations should be descriptive where possible rather than arbitrary. For instance, "No. 9 Generator Oil Switch" is preferable to "Oil Switch No. 56" (arbitrarily numbered) or even "Oil Switch No. 92" (systematically numbered). Care should be exercised to see that high tension and low tension equipment are not similarly designated. If the low tension buses are called "Main" and "Auxiliary", the high tension buses might be called "North" and "South". North and South is preferable to A and B or 1 and 2 for the reason that it is not arbitrary but descriptive of location. "Main" and "Auxiliary" is preferable for the same reason. "Red" and "Blue" makes a good scheme if the insulators or adjacent parts of the bus structures are painted accordingly. However changes in designations should not be made promiscuously for the reason that misunderstandings are likely to occur for quite some time after the change.

Where wide distinction in designation cannot be obtained between high tension and low tension equipment, the use of the words "high tension" and "low tension" should be insisted on. We have on record an accident which resulted from bus tie switches on both high tension and low tension buses being designated as No. 1 bus tie switch. An order was given to the assistant to open the disconnectors on No. 1 bus tie switch. The operator had in mind the high tension switch but the assistant opened the disconnectors on the low tension bus tie switch and was burned. As a result of this it is our practice to use the words "high tension" and "low tension" regularly as a part of the designation of oil switches and buses regardless of the fact that there may be sufficient other distinction in their designations.

GENERATORS AND EXCITERS SHOULD BE DISTINCTLY DESIGNATED

If the main generators are numbered 1-2-3, etc., it is advisable to call the exciters not 1-2-3 but 11-12-13 or by some other designation. Before a logical designation system had been adopted in our plant an accident occurred due to a workman having asked for No. 1 transformer. The

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operator for some reason thought No. 1 station service transformer was wanted and made the necessary arrangements and granted the permission to work on it. The workman however wanted No. 1 main transformer and proceeded to climb on top of it and got in contact with the live terminals and was killed. Since then the main transformers have been 1, 2, 3, and the station service transformers A, B, C.

Another accident which occurred not in the generating station but in a substation, but is nevertheless pertinent here, was due to an error being made in the numbers which were painted on the apparatus. There was a combination of other factors involved but it would have been avoided had the numbering been correct. The workman wanted to go to work on No. 69 feeder reactor and the necessary procedure for protecting him and giving him permission to go to work thereon was performed. On going to the reactor, which in this case was outside of the building in a separate housing, he found the key which had been given him, and which fitted only the lock on No. 69 reactor house, would not open the lock on the house which was designated by that number. Thinking that something was wrong with the lock he proceeded to force it with a wrench, opened the door, came in contact with a live reactor coil and was fatally burned. The investigation of this trouble developed that the reactor house had been incorrectly numbered. It should have been No. 58; No. 69 was the adjacent reactor and the numbers had been interchanged. These numbers had been repainted a short time previously. Before painting out the old numbers they had been written in chalk alongside of the old numbers. A rain storm interrupted the work of painting and washed off the chalk numbers so that the original designations were entirely lost. A man was delegated to renumber the reactor houses and went inside of the station and recorded the numbers of the feeders in the sequence in which they appeared on other equipment in the station. He carefully checked this sequence, marked all of the reactor houses outside and was checked by another man. In the original construction of the houses it seems that some structural difficulty developed which made it necessary to crisscross the reactors on No. 58 and No. 69 feeders so that their sequence was different from the sequence of all the other apparatus connected to these feeders in the station. This crisscross had long been forgotten by the men in the station and as it did not appear on any of the diagrams in use by the station men, it is quite understandable that the man should have made the mistake in numbering. While this unfortunate incident points to the necessity for accuracy in designations and numbering of equipment, it also points to the advisability of having all apparatus in the station laid out in logical sequence. The electrical designation diagram for the Holtwood plant is issued to each one of the employees in printed form with other printed safety and operating rules.

FLOODS

Hydro plants are always laid out with the "highest possible" river flow in mind. In many cases river flows in excess of the "highest possible" have occurred. It is wise to give thought to what would be done in such

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an emergency. Even flows no higher than expected because of their infrequence may require special attention There may be warnings to be given to those concerned or endangered by the high flow or high water elevations. There may be possibilities of washouts around dam abutments or around the power house entrance or deflection walls. There may be drains in the power house which should be stopped up to prevent tailwater backing up into the station. There may be doors and openings in the building at low elevations which may be flooded by high tailwater for which barricading should be provided. Such water as may come in or result from drainage in the station may be taken care of by the regular pumps used for other purposes. It may be advisable to have special suction and discharge connections made up and ready for use. This is the practice at Holtwood, where the tailwater even in an ordinary flood, is several feet higher than the operating levels in the station. A quantity of burlap bags which can be filled with sand or dirt to be used for preventing water from getting into the power house or causing washouts in case of exceptionally high elevation should be kept on hand.

OUTSIDE STRUCTURES

As far as the dam itself is concerned there is in most plants practically no maintenance work to be done on it and such work as there may be will probably be peculiar to each plant and require special treatment from the safety standpoint. Generally there should be life preservers at those points around the dam, forebay and tailrace where there may be occasion to use them. The rope attached to the preserver should be made up in a bundle which comes loose with a yank and not require any untying. Railings should be installed on all walkways above or adjacent to the water. The feeling of security which is present where the water elevation is near to that of the walkway is not a reason for omitting the use of railings. Railings are sometimes omitted in places where they occasionally interfere with work, such as at the screens. If the railings are mounted in floor sockets and made portable they can be easily removed in sections when necessary. In the winter time covered boxes containing sand should be placed at advantageous points around the plant so that sand can be frequently spread on walkways when ice is forming from sleet or spray. Infrequently used railroad tracks or grades should be cleared of weeds before passing loaded cars over them. Weeds on the track may result in sliding and loss of control of the cars. For the same reason de-railers should be used at curves, switchbacks and other danger points on grades.

FLASHBOARDS

In many cases the dam is equipped with flashboards for the purpose of increasing the effective head on the plant and these flashboards require operating and maintenance attendance which involves certain hazards. Work on the flashboards is usually done from floating equipment and the special hazards involved are security of scows, man overboard, and that of a man being washed over the dam. If the work on the flashboards is always done at times when the elevation of the water is below the crest

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of the dam the hazards are reduced to only the danger of a man falling overboard and obviously the provision for this should be one or more life preservers on each piece of floating equipment. When the work is done with water flowing over the crest of the dam or over the tops of the flashboards, particular attention must be paid to the mooring of the scows and to the danger of men being washed over.

At the Holtwood plant certain precautions are taken with regard to the security of the floating equipment, which are more or less general in their application, and will therefore be given in detail. The flashboards in this case consist of wooden boards made up in the form of panels about 10 ft. long and from 3 to 4½ ft. high and 1½ in. thick. These panels are supported on the dam by steel pins set in cast iron sockets in the crest of the dam. The principal operations consist of inserting the pins in the sockets, placing the boards against them, fastening them thereto, stopping leakage with cinders after the water elevation has come up and, previous to freshets, dismantling the boards and pulling out the pins. If the boards have been left on the dam through a freshet which has caused failure of the boards by the pins bending over, the boards will be washed away and the work consists in pulling out the bent pins and clearing the crest of floating debris. This work is usually done with up to eighteen inches of water flowing over the crest of the dam. Ordinarily this work is done by hand with the aid of an ordinary decked scow. If water is spilling over the top of the flashboards at the time when a freshet is predicted, it is necessary to remove the boards by means of a derrick boat.

The derrick boat or the scow is brought into position and maneuvered to and from the dam by a motor boat. They are prevented from going over the top of the dam by the use of, first, anchors, and, second, guard pins inserted in the crest of the dam. A series of anchors have been planted about 1,000 feet upstream from the face of the dam at 500 foot intervals across the river. A cable held up by a buoy is attached to the anchor. In bringing the floating equipment out for work the scows are first brought to one of the anchor buoys and a line attached. The scow is then moved across the stream to the next anchor and another line attached to this. The two lines attached to the anchors are then played out from the scow as the scow is advanced to the face of the dam. One anchor is sufficient to hold the scow without dragging under the most adverse conditions, but the second anchor is used as additional security. The use of two anchor lines also assists in maneuvering the scow along the face of the dam. By pulling in on one line and letting out on the other the scow can be moved without the aid of a motor boat.

It is necessary to remove the anchors during the winter season for the reason that the buoy cables would be torn loose by the ice. For this reason the anchors must be of a design which can be pulled up and yet have sufficient holding power. The steel rails cast into a concrete block originally used were unsatisfactory from this standpoint. Ordinary mushroom anchors about three feet in diameter were then used for this purpose but were found to be inadequate in rough weather and high stream velocity and it was necessary to increase the effective area of the anchors.

In addition, the scow is prevented from going over the crest by a series

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of guard pins. These pins are of steel $2\frac{5}{16}$ inches in diameter set two feet into the crest of the dam in cast iron sockets. They are set about two feet upstream from the pins which support the flashboards and are of sufficient strength and height to prevent any of the floating equipment from going over.

When the work requires that the men get out of these scows and work on the crest of the dam they are protected from going over the dam by handlines around their waists. Men on board the scows are delegated to take care of these handlines and keep them from getting tangled.

The men engaged for this class of work are principally experienced river men and the foreman in charge is an ex-seafaring man. Skillful as such men are around floating equipment sometimes they display a certain amount of delight in doing their work in a hazardous way and exhibit a tendency to scoff at safety precautions. I feel that the chance of recovering a man who goes over the dam is so slight that insistence on the use of the handline is necessary. If the dam crest is wide and is dry or if the dam is not high it may not be necessary.

SCREENS AND HEADGATES

Work in that part of the plant which includes the intake screens and the headgates for the turbines, usually called the gate house if indoors, consists of raising and lowering screens, removal of debris and cake ice, the raising and lowering of headgates in connection with the normal day to day operation of the plant, dismantling of headgates for painting and repairs, dropping and raising of stop logs in front of the headgates as well as other work of a more general nature.

Much of this work, especially removal of debris on screens, requires that men place themselves in positions where a slip or fall would throw them into the water and for this, as in other places, the handline around the waist is the preventive. A number of life preservers in readily accessible places should also be provided. Particular attention should be given to hand railings which can be made removable in sections if necessary to facilitate work.

The usual facilities for lifting screens include some kind of a crane. Where an ordinary traveling crane is used, the pull is normally vertical whereas the screens are mounted at an angle. In attempting to lift the screens with this vertical pull undue forces are put on the screen guides which may cause breakage of either the guides or the cables or may make the movement of the screen jerky and hazardous. The practice of running the crane carriage over to a position which makes the pull in line with the guides and holding it there with the controller results in burned out motors and rheostats and is difficult to say the least. A device has been developed to take care of this difficulty. A cable fastened to the crane carriage structure is run through a gripping device attached to the crane truss above the operator's head and operated by a handwheel in his reach. The cable then passes through a sheave on the truck and runs across to a similar sheave on the truck at the other end of the crane and then back to the carriage where it is fastened. This makes a loop of

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cable which, so long as the gripping device is open, idles back and forth with the movements of the carriage. When a screen is to be lifted the carriage is run over to the position to give a straight line pull on the screen and the cable is gripped by turning the handwheel. This holds the carriage securely against the horizontal pull resulting from lifting the screens at an angle.

Needless to say, the screen lifting equipment, should receive that inspection and attention which is usually required of such devices. The importance of such detailed inspection was emphasized in our plant by a grease cup dropping from the crane and falling on the head of a man below. In connection with the use of lifting equipment around the gates and screens it is wise to caution all by-standers not engaged in the immediate work to stand back so that in case of the breaking of a cable they will not be caught by it.

A matter of design which affects maintenance rather than safety, but which nevertheless involves safety to a certain extent, is that the guides for gates and screens should be designed substantially and so that the wearing parts can be renewed. I have in mind a case where guides built up of light channel iron and flats were worn through and finally broke out in several places in such a way that the gates were jammed. This in turn caused breakage of the gate lifting mechanism in a manner that might have caused parts to fly around and strike someone.

Provision for inserting stop logs in front of headgates should be made so that the gates can be taken out for repairs. The placing of stop logs is also advisable when extended work is being done in the wheel pit for the reason that the main headgate may accidentally be raised. The calamity which might result is so serious as to not justify the dependence on headgates alone. Such stop logs should be designed so that jamming with consequent breaking of lifting tackle is unlikely. Special lifting followers are advisable.

WHEEL PIT WORK

Work inside of the wheel pits requires special consideration. While the amount of work which is necessary to the modern single runner turbine is very small and does not offer any special difficulties, such is not the case in turbines having two or more runners, which is the prevailing type used in all but the more recent installations. In such turbines the entire operating mechanism is usually mechanically complicated and subject to frequent repair due to breakage, corrosion and erosion entailing special hazards particularly when the setting is vertical. The principal work in turbines of this kind consists of periodic and emergency inspections, removal of obstructions, minor repairs or adjustments of a few hours duration, major repairs and overhauling requiring the replacement of parts, some of them heavy and involving difficult rigging problems extending over periods of several weeks.

The special hazards involved in work of this kind are slipping, stumbling, inadequate scaffolding, dropping of tools or parts, inadequate rigging facilities, loss of illumination, defective portable lamp cords, accidental

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opening of headgates, operation of turbine vanes while men are working in or around them, starting of the unit electrically.

The danger of slipping or stumbling is particularly great because when a unit is first taken out it is likely to be wet and very slimy and the many projecting parts of the castings make a very uneven surface to walk around on. Furthermore the pit is usually partly filled with tailwater and if a man should fall and injure himself physically he might not be able to get himself out of the water. The slipping hazard is particularly present in single runner units where the wheel pit casing does not present level surfaces to walk on. I have in mind a particular case where a man after going down into the manhole and stepping off the ladder slipped on the inclined concrete surface and slid down into the tailwater remaining in the wheel case and was extricated only with difficulty because of slimy inclined surfaces all around him. Hazards of this kind are best taken care of by the man having a handline around his waist and by laying cleated planks for him to step on.

When extended work is to be done on a vertical multi-runner unit, careful attention must be given to the scaffolding. The flooring of course should be heavy enough not only to hold the men but to take the weight of the parts which may be placed upon it. A hand railing should be built around the scaffolding. In order to get to the different levels we have found it safer to build a stair-case in the scaffolding rather than use ladders. As the men make many trips up and down with heavy parts or tools on the shoulder this results not only in safer work but in facilitating and speeding up the work. When the job is of a minor nature or short duration, there is a tendency not to use safe scaffolding. We have found it of advantage in our case to have special planks and scaffolding parts available for nothing but this work and kept convenient so that they will always be used for these minor repair and inspection jobs.

The dropping of tools or parts needs to be watched particularly in this class of work, as speed usually requires that gangs of men be working simultaneously above and below. The men should be cautioned particularly about this because it is a hazard which does not occur so frequently around the hydroelectric plant and the men are inclined to become thoughtless. It may even be advisable to severely discipline men who are careless in this respect. The use of kick boards around the scaffolding is helpful.

When parts have to be taken out which are too heavy to handle by hand, difficult rigging problems frequently occur and rigging skill of the highest order is called for in order to do such work safely. Particular attention should be given to the type of hitches used and to the soundness of the various details of the rigging equipment. We had a case where a sling parted while a casting weighing several tons was being lowered into the wheel pit from the intake and allowed the casting to slide down the incline forty feet and crash into the turbine. Fortunately none of the several men who were in the pit at the time were injured but considerable damage was done to the turbine.

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INSUFFICIENT ILLUMINATION A SPECIAL HAZARD IN WHEEL PIT WORK

Illumination of wheel pits while work is going on requires special attention. We are all familiar with the hazards which result from insufficient illumination generally and it is more than ever a hazard in wheel pit work for the reason that no permanent facilities for illumination can be installed and because of the inherent difficulties. For this reason it is advisable to have portable lighting equipment made up and used when needed in accordance with a predetermined plan. General illumination can best be provided by a few high power units with suitable reflectors, particular attention being paid to avoid deep shadows. Provision must be made for an adequate number of portable lights. In our case the number of circuits needed is large and a pipe connection through the wall of the pit, normally capped at both ends, is used for leading in a pair of main supply wires. A portable distribution box made up for the purpose, equipped with fuses and receptacles to which the various circuits can be plugged, is hung on supports permanently mounted on the wall of the pit. Whenever any extended work is to be done in the wheel pit electricians install this distribution box and all the necessary lighting equipment before the work is started.

The duty on the drop cords is particularly severe as they are pulled over castings, stepped on and frequently lie in the water. A rugged type of heavily braided waterproof or vulcanized rubber cord is needed. The portable lamps themselves are subject to the same abuse and should be of a type which has no metallic parts which might be made alive by defective insulation. A defective drop cord may short circuit in a man's hand and burn him. Furthermore a wet lead cord in the hands of a man wet all over and climbing around on wet castings is a hazard of the worst order. Under these circumstances a shock even at 110 and particularly at 220 volts may be fatal. In any event a shock may result in a man losing his hold or balance and result in a bad fall in the pit. On account of this hazard we have abandoned the use of 220 volts in wheel pit work and changed to a 32 volt system. A 220 to 32 volt transformer has been permanently installed at a central point in the station and a 32 volt circuit run the length of the station with connectors at each unit to which the leads going into the wheel pit can be attached. At each unit there is also installed a 32 volt receptacle in which a single drop light can be plugged to take care of the frequent case of a man going in the pit for a brief inspection with only a single light. In order to prevent the danger of 32 volt lamps and drop cords being used in the ordinary 220 volt receptacles in other parts of the station, all of the 32 volt equipment has been made up with bayonet type receptacles and sockets.

The danger of all of the lights in the wheel pit being extinguished, as may be caused by electrical trouble in station, by the blowing of main fuses or accidental pulling of switches, should be guarded against by hanging a lighted oil lantern in the pit. Needless to say, this should be the practice throughout the station at night.

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SHOULD GUARD AGAINST ACCIDENTAL OPENING OF HEADGATES

One of the most fundamental hazards in connection with the wheel pit work, while not a very probable one is important because of the calamity which would result. I refer to the accidental opening of the headgates while men are working in the pit. Not only would the men be caught and drowned but even the station may be flooded by water coming from the manhole. To guard against this requires that a well established hold-off system be in force and that suitable warning signs or locks be installed on the headgate mechanism in such a way as to make the accidental opening or possibly even the deliberate opening of the headgates impossible. The particular methods used to prevent the raising of the headgates in our case were mentioned elsewhere in connection with the hold-off system. When the work in the wheel pit is of an extended nature, such as for instance of more than 24 hours duration, it is our practice not to depend on the headgates but in addition to lower the stop logs in front of the headgates. If the job requires that the pit be kept dry, leakage through the stop logs is lessened by the use of cinders. What leakage there may be is taken care of in the wheel pit by building dams of concrete three or four inches high to guide the leakage off into the draft tube manhole. The headgates should be raised a few inches to prevent the accumulation of leakage in front of the headgates.

Another hazard which might be guesome in its consequences is that of the turbine vanes being moved while men are working in them. It frequently becomes necessary to move the vanes for some adjustment or trial and while the man in charge ordinarily warns his men to stay clear of the vanes while they are moved, it is possible that somebody perhaps not directly under this man may be working elsewhere in the vanes or on some other part of the mechanism. It is also possible that one of the men may have been previously sent away from the job to get some tool and returning, goes down into the pit and possibly unnoticed gets himself in the vanes or the mechanism when it is moved.

On one of our pit jobs one of the helpers had crawled through the vanes into the runner of the turbine to enjoy a quiet smoke. The man in charge knowing that no work was being done on the vane at that instant went upstairs and ordered the operation of the vanes. The man fortunately was in the runner and clear of the vanes when they were moved. It is now the rule that when the vanes are to be moved the man in charge must see that everything is absolutely clear and then post a man at the turbine to see that no one gets near it who might not have been warned.

The danger of the unit being started from electrical end must also be considered. We have on record a case where the generator was accidentally thrown in on the bus and acquired considerable speed before it was cleared. There was no one in the pit at the time but the accident suggested that the effects might have been quite serious if such had been the case. The answer to this hazard is grounding of the generator even though the work be only on the turbine.

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TAILRACE

The tailrace of a hydro plant ordinarily requires no special consideration from the safety standpoint but at Holtwood we have a peculiar condition which has resulted in fishermen getting into some rather humorous if not dangerous predicaments. The rough river bed, through which the tailrace was cut, is flooded to a depth of several feet when the station is fully loaded, but in the light load periods the tailwater flows through the cut channel leaving the rocks on the side high and dry. Fishermen occasionally get out in the early morning to fish in the tailrace and make themselves comfortable on these rocks. About seven o'clock when the load on the station picks up the fisherman is likely to turn around and discover that his retreat is cut off by the rising water. He usually discovers it before wading is impossible but if he does not he sets up a commotion. A rescue party in a row-boat then brings him in.

Another incident once occurred in the tailrace when the water went down. There is a deflection wall between the main channel of the river and the tailrace and shad fishermen are in the habit of mooring their boats to this wall while fishing for shad with dip nets. The flow of water coming from the draft tubes at this point is very favorable for catching the shad. On this particular occasion there was an interruption of service and the station load was suddenly lost. This resulted in a sudden ten foot drop in the tailrace and the two men who were in their boat moored to this deflection wall suddenly found themselves precipitated into the water with their boat hanging up in the air above and their day's catch raining down on them. A large warning sign has been erected to caution people of this danger of fluctuating water level.

DISCUSSION

MR. MACLACHLAN: Dealing with the paper in detail, I would like to emphasize one or two points, the first being the danger from low tension shocks. We made some elaborate tests in New York a little time ago and the highest voltage a man could take with hands wet was from 8½ to 12½ volts without great pain. It is only going slightly beyond that that you run into a chance of a shocked condition, and that is not the same type of shock as a high tension, because the low voltage shocks affect the heart more. I think the paper as presented covers the matter very well, particularly in what we call the clearance. It is essentially important that a man in returning his clearance, should be absolutely certain that he is only clearing himself, and not clearing others who may be at work at the same time on the same equipment, or very similar equipment. In connection with designating apparatus by the same name by all departments, I well remember a fatal accident that we had, due to a local utility calling a line or switch by its incoming name, and the high tension substation that was supplying this utility called it by a different name as it left their station. That is, one circuit was called by two different names, hence a man got in on a live circuit, and was killed. I wish to emphasize particularly the use of hand lines, particularly around dam work, or

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around construction work on a hydro-electric plant. Men hate to use the hand lines but they are absolutely essential. In dealing with the question of the danger over the screens, in cleaning out trash, and cleaning out ice, I would point out, there is one method of protection for the man, even when the railings are taken away. If you place a four by four just on top of the racks, the man can put his foot on it, and catch his heel in it. If anything slips he has got his foot to hold him from going over in front of the racks. You need a four by four, because in winter there is ice, and possibly snow on top. Another point that I would emphasize would be the necessity, in your log winch or any similar piece of apparatus for handling stop logs, to always have the chain up when the winch is out of service, so when that winch is to be moved from one end of the dam to the other, to move your stop logs, the chance of a chain catching and spinning the winch is eliminated. I know of one case where a chain caught, spinning the winch and hitting a man in the back of the head, and he fell into the fast water and was drowned.

I wish to emphasize the necessity of adequate illumination, particularly in those places in the plant where we are told "nobody ever goes."

CHAIRMAN MORRISON: The next discussion will be by Mr. John Morse, General Superintendent, Shawinigan Water and Power Company, Montreal, Canada. In his absence, Mr. Vinet will read his discussion.

MR. VINET: Mr. Bauhan rightly emphasizes in his paper the fact that there are widely divergent conditions to deal with in different hydro-electric plants, and that the hazards of each plant require special study and treatment.

The hold-off system in use at Holtwood appears to be quite elaborate, but is no doubt justified by the station layout. At the Shawinigan Falls plant where practically all the operations of starting and stopping a unit, and raising and lowering the headgates are performed from the control room, one or two hold-off tags placed on the controller handles is ordinarily considered ample protection. The fuse plugs on the control circuits are taken out by the operator as an extra precaution.

The idea of having the workman inspect the safety devices before going on the job is a good one. Any safety measures that do not have the intelligent co-operation of the workmen are of doubtful value. The practice of grounding all electrical circuits worked on is to be highly commended and it is well worth while to locate the ground where it is plainly visible to the workmen, on account of the sense of security this gives them.

Mr. Bauhan points out the danger of accident arising when more than one group of workmen are engaged on a unit at one time. The possibility of some very gruesome accidents occurring in this way is probably always more or less present in the mind of the operating superintendent. It is a question whether it would not be the best practice to have all repair and inspection work on a given unit in charge of one responsible person insofar as the operation of the gates or other mechanism is concerned.

A simple and perfectly definite method for the designation of busses, switches, transformers and all other apparatus is very important from

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a safety standpoint. In connection with numbered switches, written switching orders have been found very useful in our larger stations.

In analyzing records of accidents over an extended period, it has been clearly proved that the largest casualties, fatal or otherwise, occur at a stage in the construction work when new apparatus and equipment is about to be put in service. This applies no doubt to all plants and is not entirely typical of hydro-electric installation. The operating man needs to be on the lookout more intensely at such times not only for the safeguarding of the operating staff in the handling of new equipment, but also to render protection to men not familiar with the operation, who necessarily have work to do in close proximity to dangerous places.

I feel that the question of safety among the employees of a hydro-electric plant depends largely on the experience and training of the men in their special work. It has come under our observation that our employees of longest standing rarely meet with severe accident, though often called on to do hazardous work. In other words the percentage of accidents should go down in direct proportion to the percentage of labor turn-over.

Mr. Connolly: Unfortunately, in the majority of plants that have come under my observation, I find that where the illumination is provided, it is usually an open wire circuit. That is very hazardous. We have the moist condition around at all times, and the insulation of the wires deteriorates rapidly, so that a man is exposed to shock for the wires are usually placed within hand-reach. Another instance I came across, where the wires on the bridge work, over the crest of the dam, were placed inside the hand rail. The insulation had broken down, and the ground was on the hand rail. A man climbing up from the gate and touching the hand rail, naturally got a shock, and likewise fell over. I believe all the wiring around those plants where the circuits are within the hand rail should be in conduits. In regard to the portable lamps I do not think they should be used except where absolutely necessary. In the number of such cases where such lamps are in use permanent circuits can be installed, which would do away with the portable lamps. Where portable lamps are in use, the circuit should be of the safety type with fibre or porcelain fittings, rather than the metallic type.

Mr. Rinke: The importance of having men around the plant who know how to handle dynamite in case of ice trouble should be considered. Along with the ice is the question of surge tank—the water freezes in the surge tank, and when it does break loose, large chunks of ice are pushed over the top, and if anybody happened to be underneath, it would be very dangerous indeed. Also, look out for fishermen. They may get into a dangerous position if they think there is an opportunity of landing a nice catch. They use steel poles, and with a wet line, in making a cast, they are apt to throw the line back into a high tension wire and receive a shock.

Chairman Morrison: The next paper on the program is by Mr. Paige, who is unavoidably detained in Worcester. Mr. Clark, an associate of his, will read the paper for him.

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RISKS IN HANDLING AND STORING COAL, OIL, AND BY-PRODUCTS

By C. E. Paige, Manager, Worcester Gas Light Company, Worcester, Mass.

The subject is treated from a fire standpoint. The accident hazards, from direct handling, are well known, and adequately covered in previous papers on design and construction of coal sheds and oil tanks.

COAL

The first thought when coal pile fires are mentioned, is spontaneous combustion. Some coals, on inspection, indicate that they can be stored under any condition without self-ignition. Others look as if they might fire easily. The great bulk of the difficulty comes with coals which do not appear dangerous until the fire actually starts.

Anthracite coal gives no trouble in storage, gas coal of reasonably good quality rarely gets afire. The great risks are in bituminous and semi-bituminous coals of poorer quality. Market and other conditions make it necessary at times to handle coals that may take fire. Usually the fire comes as a surprise. It is well, therefore, to take precautions in all cases, where there is the slightest question as to the origin or quality of the coal.

When, and if, a fire occurs in a coal pile, the dangers are of two kinds: loss in value, of coal, and the hazards to workmen dealing with the problem.

Fire risk may be reduced if precautionary facilities are provided and used. There is no danger of spontaneous combustion if suspected coal is stored under water. Such storage is not often practicable.

Coal is less likely to fire if stored under cover of a shed with air-tight sides and a good flooring.

The risk is reduced if coal can be unloaded without breakage, which often exposes new surfaces to the air and permits heating.

Some years ago, we had a pile of steam coal, about 5,000 tons, unloaded from a wooden trestle twenty-two feet high. The coal had been boomed over from the track by a locomotive crane grab bucket. The pile was about twenty feet deep. It began to heat. We opened the pile, but owing to lack of time and space, we were unable to do the work thoroughly. Our effort reduced the combustion but did not stop it. We began using water from a fire hydrant. When used in small quantities for local burning it seemed to extinguish the fire in one spot, but a little later all the coal around this spot began heating rapidly. Then we began soaking the pile, day and night. We finally got the coal so wet that the heating stopped. We do not believe that this treatment would be effective for dealing with fire in larger piles, nor with all kinds of coal. When there was no more indication of heat, we shut off the water. In a few days, the pile began to heat again. We put on water again. The menace was not eliminated until the coal was used in the boilers.

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Our shed is built with reinforced concrete plaster sides, tile roof and an oak floor. The coal is dumped from a trestle eighteen feet high, and is reclaimed by an overhead crane.

Our pile showed signs of heating. No particular precautions had been taken because we had never experienced any trouble before with gas coal.

The crane operator saw little spurts of smoke and steam issuing here and there from the pile. There was also noticeable, the acrid smell due to slow combustion.

We began using up the coal from this part of the pile, and handling over the stock. The fire was all in one end of the shed. In spite of rehandling, the zone of combustion began spreading. To prevent the spread to the main pile, we dug a deep trench through the middle of the shed, practically making two piles. We had already demonstrated that while the better coal did not show signs of heating by itself, it began to heat if in contact with coal of poorer quality.

We then opened the sides of the shed and moved a large part of the suspected coal out, piling it in heaps not more than four or five feet deep. In this way, we isolated certain parts of the pile which were very active and quenched the fire with water. Here again, we found that the real cure was getting rid of the coal.

One feature of dealing with this fire which made our work so difficult was the problem of shed ventilation. The fumes from the fire, with the steam vapor, made a condition which was most uncomfortable. One could not see more than a few feet and the foul air affected the men in some cases. In fact, we had to cut holes in the shed to provide additional ventilation. In spite of this, the men had to wear masks at certain times.

From these experiences, we learn that there are no known guarantees against this trouble. We recognize though, that the risk may be mitigated by observing a few simple rules, when it is possible to do so.

From Technical Paper No. 16—Bureau of Mines:

SUGGESTIONS ON STORING COAL

"With full appreciation of the fact that any or all of the following precautions may prove impracticable or unreasonably expensive under certain conditions, they are advisable for safety in storing bituminous coal.

1. Do not pile over 12 feet deep, nor so that any point in the interior of a pile will be over 10 feet from an air-cooled surface.
2. If possible, store only screened lump coal.
3. Keep out dust as much as possible; to this end reduce handling to a minimum.
4. Pile so that lump and fine are distributed as evenly as possible; not, as is often done, allowing lumps to roll down from the peak and form air passages at the bottom of the pile.
5. Rehandle and screen every two months, if practicable.
6. Do not store near external sources of heat, even though the heat transmitted be moderate.
7. Allow six weeks' "seasoning" after mining and before storing.
8. Avoid alternate wetting and drying.

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9. Avoid admission of air to interior of pile through interstices around foreign objects, such as timbers or irregular brickwork, or through porous bottoms, such as coarse cinders.

10. Do not try to ventilate by pipes, or more harm may often be done than good."

Technical Papers 2 and 16 and Bulletin 136, all prepared by Horace C. Porter and F. K. Ovitz and issued by the Bureau of Mines, will be found very valuable to those interested in this subject.

OIL

Gas oil is a raw material which should offer very little menace as a fire hazard, providing the simplest precautions are observed.

I quote from a well known authority on the subject:

"The storage of gas oil in connection with gas manufacturing plants should be in steel tanks with tight steel roofs. Underground concrete tanks are suitable and safe, but the expense is usually prohibitive, unless real estate is very limited. As gas manufacturing plants are permanent institutions, steel storage tanks used for gas oil should be of a heavier design than is common in ordinary oil field practice. I would recommend that they be designed with not less than a safety factor of 3 when fully loaded with water. The roofs should also be heavier than usual oil field practice, and I would recommend that the roof plates be not less than $\frac{3}{16}$ inch thick. The lighter roofs usually furnished on standard tanks are subject not only to quicker corrosion but also will not remain tight in service. All fittings on the tanks, such as nozzles for connecting pipe lines, should be of cast steel. There should be swinging joints in all pipe lines that connect to the sides of the tank, and double valves are a wise provision. There should not be any bottom connections.

"The vent from the tank should be properly screened and frequently inspected so as to insure that the screen is neither clogged nor corroded.

"The gas oil storage tanks should be as remote from operating buildings as is possible on the plant sites involved, and should in any event be surrounded by emergency dikes which would impound the contents of the tank in event of its collapse. Where the real estate is available earthen dikes 6 to 8 feet high, forming a basin which will hold 50 per cent more than the capacity of the proposed tank, are the cheapest and best protection. Where the real estate is limited, concrete dikes, or even steel dikes, may be used, but I personally am not inclined to favor the steel dikes as they are likely to be destroyed by the heat from the burning oil. I consider that the diameter of the dike wall, if high and made of either steel or concrete, should be at least 50 feet greater than the diameter of the enclosed storage tank. Between the shells of adjacent tanks there should be a space not less than the National Board of Fire Underwriters require for fuel oil storage.

"The tank should be thoroughly grounded and all openings except the screen vent be made perfectly tight, and with these precautions there is very little likehood of ignition by lightning even if the tank is struck.

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"The tanks should be equipped with a so-called safety steam line, which is merely a pipe normally empty connected to the general steam supply of the plant and having two or three, or more, inlet connections into the tank near the top angle. The valve admitting steam to this line should be not less than 50 feet away from the tank, and preferably more. If the tank gets on fire and the roof is not blown off, the admission of steam through this safety line will put out the fire.

"It is very useful to have the piping and pumping arrangements so that in the event of fire occurring in one tank, the contents can be rapidly pumped out into another tank, reducing the loss.

"There should, of course, be ample high pressure hydrant and hose water protection for cooling the sides of any burning tank and protecting surrounding property.

"I suggest that you refer to the Rules and Requirements of the National Board of Fire Underwriters for the Storage and Use of Fuel oil—1920 edition, as most of the recommendations are applicable to gas oil.

"As for the storage of oils, the Fire Prevention Commission of Massachusetts, has drawn up articles for storage and handling of oils both of an inflammable nature, such as naphtha gas, etc., and also the heavier grades of gas oil, fuel oil, etc. Regulations for additional grades of oil are in the hands of the printers at the present time. These state regulations are practically the same as the insurance companies' regulations, except in a few points which are as follows:

1. Distance of tanks from building.
2. Lightning protection in steel tanks.
3. Type of construction of dikes surrounding the storage tanks above ground.

"As for the regulations for the storage, handling and use of heavier oils, the following are the regulations drawn up by the Boston Board of Fire Underwriters which were adopted by the Massachusetts District Police and became effective January 1, 1920. They are applicable to liquids having a flash point above 150 degrees F. These regulations specify the following:

(1) The circulating pump must be located above the highest oil level of the oil storage tank and all of the piping pitched, so they will drain into the storage tank.

(2) The suction and discharge lines must enter and leave the top of the oil storage tank.

(3) Filling and suction pipes must extend to the bottom of the oil storage tank.

(4) Direct flow from an overhead tank to a surface tank is not permitted. However, this is sometimes allowed when a pump intervenes.

(5) Each storage tank must be provided with a manhole and vent pipes with brass mesh screen.

(6) Each storage tank must be provided with a steam fire prevention pipe.

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(7) Check valves must be placed in pipe lines as close to the oil storage tanks as possible to avoid siphoning.

(8) Valves must be placed in suction and discharge lines to and from the storage tank, as close to the tank as possible.

(9) Overhead tanks must be provided with a dike of 150 per cent capacity. The height of the dike is to be not more than one-quarter of the height of the tank. If the dike is made of earth the slope must be 2 to 1, and the pipes may not be below the top of the dike.

(10) Underground storage tanks must be covered with at least three feet of earth.

(11) Each installation must be approved by the authorities on its merits. In an isolated location, certain modifications of these requirements are permitted, except in Massachusetts.

TARS AND HEAVY OILS

"Fuel oils, if used for steam purposes in boiler furnaces, offer some hazards to firemen from 'flashbacks' in the burners or explosive mixtures in the furnaces accumulating before ignition.

"Coal and water gas tars if properly confined, are not much of a fire risk, but tarry residues, or spill, if ignited in open tanks, offer a very serious fire menace. The acrid and very dense fumes from tar fires, make them one of the most difficult fires to fight. Water is not a very good medium for extinguishing such fires unless the tar is confined and there is room for flooding water on top of the tar, thereby excluding the air.

"Tars, especially coal tars, burn the skin of workmen, and if particularly aggravated, burns result in foreign growths, like keloids, which may mean operations on the affected parts.

"The same burns, sometimes result from the handling of light oils, like benzol, toluol, xylol, naphthas, drip oils, and naphthalenes.

"This group of substances also are very volatile and evolve large quantities of vapor at ordinary temperatures. They are, therefore, very flammable, and constitute the greatest fire hazard to a plant if stored in very large quantities. During the war times, many plants had to use special precautions with respect to fire hazards caused by the manufacture of these oils. Due to market conditions today, however, very little of this material is stored in gas company plants.

"Ammonia is not combustible, but if fires start and the heat is sufficient to evolve the ammonia gases from any ammonia compounds in the vicinity, the fire fighters are seriously handicapped by the suffocating ammonia gas.

COKE

"Coke does not materially increase the fire risk of a plant, and if coke is ignited, the fires are easily extinguished by water.

"Coke handling, however, does cause numerous injuries to workmen because of the sharpness and hardness of the lumps. They cause cuts on feet improperly shod, and cuts on hands. Falling lumps from overhead handling are a source of danger. Fine coke dust is a source of many eye

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injuries, due to its hardness and sharpness, cutting the eyeball if not immediately removed.

"In some plants, hot coke operations cause burns to workmen.

"Spent purification material (iron oxide and shaving mixtures), often contain over 50 per cent by weight of free sulphur. This material, if ignited in any way, or if fired from spontaneous heating within the batch itself, makes a very stubborn fire to extinguish, due to the sulphur fumes affecting the workmen.

"The firing of this material can be done in the purifiers if when revivifying the foul oxide too rapid a flow of air or too much air is passed through. The ignited sponge then is a source of danger from explosion of gas and air mixtures when gas is turned through the mass."

GAS HOLDERS

There have been accidents known to happen to gas holders, some due to fire, and some due to rupture of the shells from one cause or another. Gas holders are frequently struck by lightning during thunder showers, but being, as a rule, perfectly grounded, no damage results. There is one case of a fire which occurred in Springfield, Mass., some years ago, which may interest you.

"The information is from the insurance company inspector's report. He got his information from the chief engineer of the street railway company, who stood on a coal trestle at the same level as the holder and was an eye witness of the accident.

"A 300,000 cubic foot holder was destroyed by fire caused by lightning. This holder was surrounded by a cylindrical brick building with a conical roof built of wood covered with slate. The wooden rafters of this roof rested on the brick wall at the base and were supported at the peak by a wooden ring. Upon this ring rested a ventilator, also built of wood; on this ventilator was a lightning arrester which was evidently defective. The lightning struck the ventilator, setting it on fire. This burned down until it burned the rafter support; when this occurred the roof collapsed and one of the rafters ripped a hole in the top of the holder, allowing the gas to flow out and become ignited by the fire in the ventilator. There was at the time about 240,000 cubic feet of gas in the holder. This burned up in one column of flame reaching above the power house smoke stack which is 225 feet high. The valves were shut on the holder and the fire burned itself out. Although this holder is one of a nest of three, neither of the other holders were injured by the heat. A 2,000,000 foot holder, only 0 feet distant from the one destroyed, had a considerable number of bricks thrown into the pit from the wall of the building, which was pushed over when the roof fell; and these were removed later by a diver.

"At first, it was thought that there was an explosive mixture in the building, but this was not a fact, as the ventilator burned for 20 minutes before the roof fell. There was no explosion at any time, simply one long column of flame until all the gas was consumed."

Since there is no oxygen stored with illuminating gas, an explosion from ignition is very unlikely. In many cases where gas holder fires

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have occurred, the gas burns at the place where it escapes into the air from the holder, until all of the gas is consumed. Quite often the gas has been pumped out of a burning gas holder to a place of safety.

Those who are interested in the coal matter discussed in this paper may refer to the following publications:

"Safe Storage of Coal", by Mr. H. H. Stoek. (Technical Paper 235, issued by the Bureau of Mines.)

"Preventing and Detecting Leakage of Soft Coal Piles". (Abstract No. 6861 of the A. G. A. Bulletin of Abstracts for March 1, 1921.)

"The Storage of Bituminous Coal", by Mr. H. H. Stoek (Circular 6, issued by the University of Illinois, Urbana, Ill.)

"The Weathering of Coal", by S. W. Parr and W. F. Wheeler. (Bulletin 38, issued by the University of Illinois, Urbana, Ill.)

"The Spontaneous Combustion of Coal", by S. W. Parr and I. W. Kressman. (Bulletin 46, issued by the University of Illinois, Urbana, Ill.)

"Effect of Storage on the Properties of Coal", by S. W. Parr. (Bulletin 97, issued by the University of Illinois, Urbana, Ill.)

"Coal-Storage Practice", by H. H. Stoek. (Bulletin 116, issued by the University of Illinois, Urbana, Ill.)

"Stabilization of the Bituminous Coal Industry", issued by the U. S. Bituminous Coal Commission.

CHAIRMAN MORRISON: We will now have the first discussion by Mr. Mitchell.

MR. MITCHELL: We all have coal problems during the annual coal scare. I have had some experience, possibly a little more with the hazards in the storing of coal than I have oil or coke. Sometimes it is a problem to find sufficient space to store enough coal for a hundred and twenty or a hundred and fifty days, and we found, in storing coal, by piling it not higher than twelve and one-half feet, and by leaving an area way, and not having it piled continuously, we were successful in keeping down the fire hazard. The matter of ventilating pipe has been mentioned. We use a 1¼ or 2 inch pipe in these coal piles, not for the purpose of ventilation, but for the purpose of taking the daily temperature test, watching them very close, a man going over them every day with an ordinary thermometer, and when the piles begin to heat, he has knowledge of it, and immediately reports it, and that hazard is removed. It was found if we could get a coal low in sulphur, it stored very nicely, particularly a lump coal low in sulphur. On the gas oil storage the only thing I might add is the ventilation in the storage tank. A tank of considerable size, say 100,000 gallons, I think should be provided with a gooseneck ventilation pipe protected by a screen. Should there be no ventilation, the tank might be exploded, and the town blown up. We have very little difficulty in storing coal oil or drip oil. Most of the accidents we have had are eye injuries, due to splashing. I have no record of fire accident from handling oil but I do know of a fire that occurred where oxide was thrown to the generator house, and out of a window, and was piled some sixteen feet high and took flame, and did very much damage to the generator house. We find in cleaning the outside boxes it is easier

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for the men to work in the outside boxes after they have been ventilated at least a day, and then clean them out as rapidly as possible, not allowing the men to remain in there more than ten or fifteen minutes. To prevent a gas holder fire, I think is largely a matter of construction—a matter of engineering. I don't think that a gas holder should be constructed near any wood structure.

MR. CONNER: The subject opens up a very broad field for recommendations and suggestions. Taking up the coal, for instance, and eliminating the points touched on by Mr. Mitchell. I would go a little further and state in the handling of coal, we have to contend with the coal dust hazard, especially in and around the crusher pits. In instances like that the pits should be as well ventilated as possible. The lighting facilities should be of the enclosed type, enclosed circuit, with the vapor-proof lamps, and the switches on the outside, so there will be no chance for ignition of the dust from a spark from the switch. We also have the dust to contend with in the bucket conveyor, and the belt conveyor, carrying the crushed coal from the crusher to the bunker. An explosion has been known to occur from the dust dropping from the bucket, falling down in front of the boiler and igniting there, while the fireman has the door open.

In regard to storage—tank storage—the main feature there is the vents. I have come across quite a number of oil storage tanks with one-inch pipe vents. Now that is entirely too small, because the one-inch pipe soon gets corroded, clogged up. The vent orifice is very small, dirt, trash, gets into it, and it is clogged up solid, so there is no vent whatever for the gases from the tank. Underwriters' rules, I believe, call for four-inch vent pipes, or if you have a two-inch pipe, the flanges on the goosenecks should be built up to four inches, so you have a four-inch opening there with the casting. There would be less chance of the entire four inches being clogged up. One of the worst hazards I find in the handling of oil is the unloading of oil from tank cars, especially from the man-holes, because I believe all gas plants unload the tanks through manholes. The cars are spotted on the siding, the manhole cover removed, and probably a piece of burlap put over the opening to exclude cinders, but nevertheless the gas is escaping, and the sparks from passing locomotives are liable to cause an explosion. We recommend to all our plants that the line be supplied with sliding gas cover, so the gas cover comes down and covers the manhole, so if there are any sparks around we feel reasonably safe. In regard to tank storage, I also find tanks are stored pretty close, where, if a fire occurred, it would probably drive the men out of the building. I believe fire walls should be built between the tank and the building.

ADJOURNMENT.

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Get Together Luncheon

Tuesday, September 27, 1921

CHAIRMAN MORRISON: The first gentleman who will talk to us is Dr. D. D. Barnum, President of the Boston Consolidated Gas Company.

DR. BARNUM: As a citizen of Greater Boston, in the employ of the Boston Consolidated Gas Company, I welcome you, individually and collectively, to Boston. Boston, one hundred and fifty years ago, was a very different place than it is today. If you look at some of the old prints and see how few people there were on the streets and the apparent slowness with which they moved, you can imagine the difference in living here now that we have the high pressure steam and high speed engine, combustion engine, gas, and the electric generator. In those days I can imagine that the inhabitants were more interested in protecting themselves against loss of property and loss of life by assault or robbery, than they are today.

About a year ago I attended an inauguration of a college president. One of the professors, in his talk, said that they had perfected an instrument for measuring intelligence, but unfortunately they found very little intelligence to measure.

During the first years of the war, Lord Roberts said, "If you are going to raise an army of several million men, you have got to raise every last man"—and you gentlemen have got to educate every last man in your organization, and, unfortunately, among public utilities, we have to educate the public; we have got to educate the men above us as well as the men below us.

I remember a good many years ago I was superintendent of a plant. We hired an errand boy. Along in the forenoon (he hadn't been there more than two or three hours) we heard some one yelling, and the foreman came in and said, "That young scamp is up on top of the holder, waving to us to look at him." Well, I didn't know whether the superintendent needed education or the boy; but it shouldn't have happened. The boy should have been educated first. So you see, the education must be from the top to the bottom.

CHAIRMAN MORRISON: It affords me very great pleasure to introduce the next speaker, Dr. William McClellan. Dr. McClellan was formerly Vice-President of the Cleveland Electric Illuminating Company, formerly connected with the public service commission in the City of New York, and also therefore a public utility man, formerly Dean of the School of Economics and Finance at the University of Pennsylvania, consulting engineer, and today the President of the American Institute of Electrical Engineers.

DR. MCCLELLAN: When a person comes to talk to you on an occasion of this sort, he is supposed to say something nice, and he usually cogitates a while to know just what nice thing to say, but it is particularly fortunate that although he hasn't had much experience with your organization and he drops in on it as a sort of a visitor, he discovers that he

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can say something that is pleasant. I want to say frankly that from the glimpse I had of your meeting, it struck me that you had about as meaty a discussion as I have heard for a very long time; a discussion on subjects which are just about as worth while as anything that can be discussed in connection with the public utility industry.

SAFETY MOVEMENT A GREAT ECONOMIC AS WELL AS HUMANITARIAN MOVEMENT

But there is one thing I would like to bring before you today, that I think is important to you, and I think it is important to us who have managed public utilities and expect to manage them; and that is the fact that too many people look on this safety movement as a sort of eleemosynary thing, a very beautiful thing, to save human life, a very beautiful thing to keep people from suffering and having accidents. Of course, those who are in it know what a vital thing it is, but I don't think every one else does, and I believe that it is necessary for every man who is associated with this work to know that there is a genuine fundamental economic reason for this movement, that it is part of a great general movement all over the world, not only in saving human life and preventing accidents, but a very much larger economic movement than that, and that this work you are doing, and you men in your positions are a vital part of the industrial development of the world.

In making such a statement as that, I think I ought to illustrate it and in a sense prove it to you, and perhaps the story is a short one, but nevertheless it will take me five or six minutes to tell it anyway. Those of you who are over forty know from experience, and those who are under that know from hearsay, that the old slogans of this country used to be "Go out and get it;" illustrated also when Horace Greeley said, "Go west, young man!" Resources were plenty, lumber was everywhere for the cutting down, ripping up and using; beef, one of our principal foods, was raised on the public ranches; coal was mined very easily, the outcroppings in many cases more or less inexpensive mining; the soil was rich—you heard nothing about fertilizer; immigration flowed to us in a constant stream; we had plenty of common labor to dig the ditches and to do that kind of thing; government was simple; taxes were not very high (it is in the memory of all of us when there was practically no public debt at all in the United States); living was very simple; pleasures were simple—very little money was spent on that sort of thing; the scale of living was lower, and this was what we called a country where a fellow could come and almost do what they used to tell the emigrants abroad when they were coming here, "Go over there and you will find the gold on the trees ready to be picked off and you will find it in the streets ready to be picked up."

The great country was undeveloped at that time. Twenty towns started in a day, all over the country, and that meant that any young man who was on the job and went to a new place could start a store; he could do this, that and the other thing and get into business and make money quickly and grow up with the community.

Now a great change has taken place. The country is still rich in

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resources—probably not the richest continent in the world today, but it is developed; opportunities of an Eldorado nature, a get-rich-quick nature, are not so easily to be had, and, looking over these same conditions, we find them all different. Lumber is in a very distant location and must be brought here with heavy freight rates. Beef is now raised on ranches, must have a good deal of attention, which is partly the reason for the higher cost of meat. Coal is much more expensively mined. Hardly any mine in the country can be operated as cheaply as the old mines. We hear a great deal about fertilizer; soil that is near the markets and available has been worked out, and we hear of nitrate plants and things of that sort. This country must have nitrate or fertilizer. Government has become exceedingly complex, which means money spent for government coming out of our pockets, the burden on industry, the burden on the individual earnings, is very great indeed. Pleasures are exceedingly complex. The trolley car, the park, the movie, all those things enter into our life—don't misunderstand me: they make life more worth while; they are tremendous factors in this higher scale of living that we want to get for ourselves and that we want to see our men who work for us get, but nevertheless the cost is very great. The same remarks can be made of railroads—very difficult to manage compared to what they were before.

Now, what does it all mean? Look around and see what is going on, because in judging a movement of your own, gentlemen, it is always wise to find out whether it is just a little wart or excrescence on the surface of things in general, or a part of a great economic development.

Think for a moment of the old days when anti-slavery up in this region was such a vibrating topic of such absorbing interest in the hands of the old abolitionists, and how they were looked upon as people interfering with the economic development of the country, how they were looked upon as uplift people, as people of a charitable nature; and yet we know now, after the battle is all won, that they were really fighting a great economic battle in this country; we know now that slave labor was not economically good for any country, aside from any moral aspect that it might have had. Therefore, in looking at your own activity, a relatively new one such as this is, it pays to look at it and see what relation it has to the great flow of world movement, because every little stream, you know, trickles into some larger stream, and we have what we call systems.

SUPER-POWER SCHEMES, CONSERVATION OF NATURAL RESOURCES, ELIMINATION OF WASTE, AND ACCIDENT PREVENTION ALL IN SAME CATEGORY

What I am trying to point out is what relation this great movement has to the great economic trend of the world, so if you will glance over what was happening, what do you see as distinct from what we had years ago, when I was a very young man? Water powers have taken on a new aspect entirely. A water power bill has finally gone through Congress, which we hope will be effective in developing the water power of this country. Super-power schemes are being studied and worked out. You know the big work that is being done by the Super-Power Survey. What for? To conserve capital, to conserve resources that we begin to see need

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conserving. The St. Lawrence River proposition—wonderful, so far as the preliminary discussion has brought out its advantages. Good roads—same thing, same idea. A waste report, which has studied industry and is trying to get rid of every kind of waste that can possibly be thought of. Your own safety campaign—I put it in there to show that it is one of a great number of important movements having to do with the economic development of this country.

In other words, instead of the old slogan, "Go out and get it, pick it up," instead of "Go west, young man, to this untouched region," the word now is, "Work and save"—save human life; but far beyond all that is the fact that if you save human life, you increase the world's well-being by increasing the production from that life.

That is the reason we are studying coal mines and trying to get in the coal mining industry a method by which not only lives will be saved, but that the working conditions will permit those men to work at regular hours and every day of the year, so the maximum output of all that human energy will be available. That is the reason some of us don't believe in immigration laws against this country, except to increase the intelligence, but not keep out anything that is intelligent. Why? Because it represents our future capital, which is no longer to be dipped up in ladles, so to speak, out of the ground, but which is to be true capital, the saving of human effort. Therefore, I say to you, to come back to this latest movement of saving, that they are trying to get in Washington some method of settling this unemployment problem. For years and years we have had financial panics, and in the midst of a panic they held meetings: "What are we going to do to stop them?" But they gradually came around to the point when they said, "Well, we can't, in the midst of a panic, devise a machinery"—it takes years to do that—and they worked and worked and worked at it, until they got a federal reserve system for capital, for money, so that it would be mobile, so that it would flow back and forth wherever it is needed in the country. Much as I honor the men working at it, much as I work at it myself in connection with the Joint Reserve Bureau in New York, nevertheless I realize what we must have in this country is a federal reserve system for labor, that will make it mobile, just the same as we have a federal reserve system for capital.

Therefore, the thing I am trying to point out to you is this great difference in our country; the change that has taken place, that is, that we must save—save everything. That is where our capital is going to come from. We need it for foreign trade, for home development, for a great many things. It will be available. But I believe the reason the railroads today are having difficulty in getting capital, that they need, is because of an underlying belief on the part of everybody that the railroad system today is not in condition to make every dollar that they get produce the greatest amount. Our other utilities have gone and solved that problem to a far greater extent, and you have a tremendous part in it, a tremendous part, and I think you ought to go home not only with that in your mind, but I think you ought to carry it to your executives.

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CHAIRMAN MORRISON: It gives me great pleasure to introduce Mr. C. B. Connelley, Commissioner of Labor and Industry, State of Pennsylvania.

MR. CONNELLEY: There is one thing that is very close to my heart, and that is rehabilitation, the re-creation of the man that is injured in industry. You know what the war has done; you know what this industrial physician is doing; you know what the public utilities are doing, and I want to say that you are doing a better piece of work now than has ever been done before, and you are being recognized as such and you are being credited as such, because without the public utilities of this country we would never have gotten where we are today.

REHABILITATION MAKES THE INDUSTRIAL CRIPPLE STILL USEFUL TO HIMSELF AND SOCIETY

I am very glad, because we tried some years ago, through the United States Steel Corporation to make it possible for the man who was injured in industry to be placed in another position, or the position he had after he returned to work.

Now this is what they are doing. In rehabilitating the man in the industry, we find that after he is injured, there is nothing left but the mind, illiterate in his own language, if you please, and then we have to re-create that man, that human being who can neither read nor write in his own language, and we expect much of him.

The public utilities in this country are doing, as are the other industries of the country, a great work by making it possible for that man to be re-created again and in a sense live over, be re-born, and in that we are going to make it possible to have that man love the country of his adoption.

There is one thing I would like to do, if it were possible, namely, have the men who control the public utilities understand just exactly what you men are doing and what an institution of this kind, the National Safety Council, is doing, and why it is really worth while. If you can have the head of your department understand what you are doing in this work here in the National Safety Congress, you have not only made a convert of him, but it is going to make your work better and really worth while.

ADJOURNMENT.

WEDNESDAY MORNING SESSION

ELECTION OF OFFICERS

CHAIRMAN MORRISON: The first business is the report of the nominating committee.

MR. CHARLES B. SCOTT: Your committee moves the nomination and election of Mr. J. F. Naylon as Chairman, Mr. Eugene Vinet as Vice-Chairman, and Mr. A. O. Mitchell as Secretary.

CHAIRMAN MORRISON: Gentlemen, you have heard the report of the nominating committee, and I would like to know if there are any sugges-

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tions for any other names as officers? If not, then I assume that it meets with your approval.

MR. H. B. HARMER: I move the secretary cast one ballot adopting the report of the nominating committee unanimously.

(Motion seconded, put to a vote, and carried.)

CHAIRMAN MORRISON: We will proceed to the first paper. I take pleasure in introducing Mr. Downey.

THE DEVELOPMENT OF ACCIDENT PREVENTION AND FIRST-AID WORK IN THE TELEPHONE FIELD

F. M. DOWNEY, SPECIAL AGENT, NEW YORK TELEPHONE COMPANY, NEWARK, N. J.

In our business, as it is today, there are no particular hazards. It is true there is and always will be certain contributory causes leading up to accidents, but these causes should, we believe, in no sense be called hazards. Telephone plants in poor condition or not constructed in strict accordance with specifications, poles which require replacement, and the presence of non-standard construction on jointly used poles, may be listed as known causes of accidents.

There is a feeling existing among those outside of our business that line work is particularly hazardous. This theory has been exploded for all time for we have no greater number of accidents among this class of labor than any other. In fact in 1920 in the line force in the division of the Bell Telephone Company whose work has been selected for today's discussion the number of accidents was far below that of any other class.

When the accident prevention movement was in its infancy employees at large did not take it seriously and it was more or less ridiculed. It was the prevailing opinion at that time that an accident was pre-ordained or arranged by fate and nothing could prevent it. I will attempt to point out the conditions as they were at that time and what has been accomplished to date.

About 8 years ago in spite of the fact that we have done a great deal towards preventing accidents we continued to have what we considered an abnormal number of lost time cases.

When one reviewed the statements of accidents sustained by employees of the operating companies of the Bell System the natural question was, "Cannot something be done to materially reduce these wholesale casualties?" None of the associated companies of the Bell System, so far as we could learn, had undertaken any constructive work along these lines and we were unable, therefore, to obtain the benefit of studies or experiences. It was consequently necessary to work out our own salvation.

We mapped out an intensive campaign and organized accident prevention committees. These committees worked out a definite plan to carry out the program. Suitable forms were prepared and distributed widely to the working forces asking their co-operation in reporting hazardous con-

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ditions. The proposition took real effect and we succeeded in clearing up a good many hazards in the plant. By acknowledging receipt of the recommendations from the field workers and later advising them of the final disposition of their suggestions we were able to add many enthusiasts to the movement. This was unquestionably a first class asset, because it was a real step towards gaining the support and confidence of the forces. A review of a number of accidents which occurred at that time seemed to indicate that with a little thought and precaution on the part of the workmen or the foreman in charge of the job, several of the cases might have been anticipated and therefore avoided. We next gave attention to this phase of the work.

During the first two years of our campaign we were naturally progressing through a series of experiments and no attempt was made to compile elaborate records. However, we observed that, despite the fact that the men had been given an unusually safe place to work, had been supplied with a great many safety devices and instructions we continued to have accidents—not particularly serious, but in sufficient number to make it essential for us to take steps to reduce them.

To start the year 1915 we determined to maintain a statistical record of accidents with a view to reaching a conclusion as to the best methods to pursue to reduce the losses. By persistent application of the practices already suggested, we attained a figure of 7.4 lost time accidents per 100 employees for the year. When we analyzed this mark we felt it was too high considering our efforts, and we resolved to better it in 1916.

We started well but the finish was even worse than the preceding year; the final result being 9.4 lost time accidents per 100 employees.

Due to the war activities forcing a curtailment of our program and the employment of much new and inexperienced help, the year 1917 was a particularly unfortunate one for us. From a figure of 7.4 accidents with loss of time per 100 employees in 1915, and 9.4 in 1916, we rose in 1917 to 11.3 accidents with lost time per 100 employees. We are all familiar with the conditions existing during 1917 and up to the signing of the armistice in the latter part of 1918. The labor turnover in our organization was very high and many of our people who had been specially trained in our work were entering the military or naval service. We lost a great deal of ground and conditions following the armistice went from bad to worse with the result that our figures for accidents with disability for the year 1918 reached the hitherto unbelievable mark of 13 injured employees for every 100 employed. The time for action had arrived.

To start the year 1919, the problem was studied with as great care as was possible and we decided upon a campaign more intensive than any heretofore launched. We first set out to arouse the fullest interest and enthusiasm of all the force, including the supervising people, for without a supervising force working in harmony we found our efforts would not be successful. We further saw the necessity of acquiring the confidence of the forces and stamping out any antagonism and unjustified criticism which had been directed toward our efforts. The several safety commit-

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tees were called together and the need of concerted action explained. The forces rallied, aroused to the sense of their responsibility for their own welfare. Strange to relate, despite what we had done, we were in the first month of 1919 worse off than ever, and the outlook for the future was very dark. A review of the situation together with careful studies that were made indicated that a large percentage of the accidents we were having were due either to carelessness or thoughtlessness of the person injured or his fellow employees. It was apparent that the most fertile field for us to bring about a reduction in the number of accidents was in the education of our people to be thoughtful and careful of their own safety and the safety of their fellow employees on the job. Well, we got on the job at once and the result was in a force of about 1,800 men the particular division did not have a lost time accident for 65 consecutive days. Our "run" was broken on the sixty-sixth day by a comparatively slight injury, a sprained ankle, sustained by a foreman. We believe in our accident prevention work that if an employee's injury is slight, and he cannot perform his regular job, he can be used elsewhere. For example, a foreman can, in case of a slight injury which may prevent his working on the job, direct his forces from the office or do other constructive work. In the case of a lineman or an installer there is usually work in the storeroom or shop on which he can be used to advantage, provided of course, the employee is physically able. We sent a man around to this particular foreman's home with the idea of getting the story of the accident and if advisable bringing the man to the office. His heart was in the right place, and he did not want to be the one to break the "run" and was willing to come back on the job. Just as he and the men who had been sent for him were going out of the house, his wife appeared and despite their pleadings, she refused to let him return to work, and he didn't. So our 65 day record had been broken and a woman helped to do it. This unfortunate incident did not discourage us. On the contrary, it was if anything, probably a good thing for our accident prevention movement. We started again and for the year succeeded in reducing our lost time accidents per 100 employees to 3.7 compared with 13 per 100 employees for the previous year. The campaign of education which was undertaken has been continued and by constantly keeping before our people the necessity of being careful, our problem has been simplified. The best performance to date in our division was recorded in 1920 when a figure of 2.8 lost time accidents per 100 employees was established. This compares with a rating of 6.3 per 100 employees for the entire company.

FIRST-AID AS A PREVENTIVE AS WELL AS CURATIVE MEASURE FOR ACCIDENTS

Feeling the need of a knowledge of what to do in case of injuries sustained on the job, we tried out in the fall of 1920 an experiment in training groups of our people in first-aid to the injured. We believe that first-aid is first and foremost a cure and while separate and distinct from accident prevention, it is unquestionably of great value and will certainly aid us in our efforts to reduce the disability following accidents.

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About the middle of last November we sent to each employee who was eligible to take the training a circular outlining the course to be given on the employee's own time. We had tentatively set a mark of 100 as the possible number who would avail themselves of the opportunity. To our surprise nearly 600 employees, or approximately 40 per cent of the plant force eligible for the first-aid training responded to the invitation.

Beginning early in January, 1921, 45 employees representing the various sections of the division were selected from the total registrants to take an instructor's course under a physician who was authorized by the American Red Cross association to carry on the work. Instructions were given three nights each week at division headquarters. In 23 days the courses were completed, and an examination was then conducted under Red Cross auspices. Every one of the employees (except one man who was prevented by illness from completing the work) passed the test with very creditable marks. The Red Cross authorities considered this an excellent showing and awarded each person a Red Cross certificate for proficiency in first-aid work, and an authorization to carry on the work as lay instructor. Then the remaining employees who had registered for the training were divided into classes according to locations where they were employed, and the instructors at these points were assigned classes. The field classes started the first week in February and were completed early in March. The Red Cross organization then conducted examinations and of the 287 people who responded for the examinations, every one passed with a very satisfactory mark, and were awarded certificates. After the examinations, 36 five-man teams (or 180 odd people) representing the various sections and working forces of the division were formed and intensive training begun under the direct supervision of the first-named instructors. The idea back of the team work was to have the largest possible number of men participate in the first-aid team practice as often as opportunity afforded, the practices being held in the evenings on the employees' time.

After approximately two months of team training, elimination contests were staged at the several central locations in the division to determine the best teams in the respective sections. The winners of these elimination contests were then brought together for semi-final contests to determine the twelve best teams in the division, the survivors of the semi-final contests to participate in the final competition for the division championship, trophy and medals. On the evening of the contest, the armory was taxed to its capacity, over 4,000 people witnessing the competition.

It is not possible, nor is it desirable to express in definite terms to what extent the employees, the public and the company have mutually benefited as a result of this first-aid training. We are not at all certain that it will cut down the number of accidents, but we hope it will. We are reasonably certain, and we speak from the experience of other industrial concerns who have adopted first-aid training, that we can reduce the seriousness of accidents as measured by the number of days lost time due to the accidents. In one of the operating companies of the Bell System there has been a steady decrease in the number and seriousness of accidents.

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There are already several cases on record where our people have rendered assistance to the public and in one specific instance a life was saved after it had been despaired of by bystanders who were not familiar with first-aid and its value.

THE ESSENTIALS OF SUCCESS IN SAFETY AND FIRST-AID WORK

We have learned by experience that there are several factors which are necessary to progress in accident prevention and first-aid work.

First—it is a vital necessity to have the wholehearted and cordial co-operation, support and interest of the forces, both the supervisory and working classes, and all who have any bearing on the work. The forces and committees must work with faith, for unless the foundation of belief is prevalent the road will be rocky and results scanty.

Second—competitive first-aid demonstrations are invaluable because they serve to maintain the enthusiasm already manifested. When properly planned and advertised the first-aid team contests bring out the crowds and a great many lukewarm employees are convinced.

Third—the publishing and distribution of periodical bulletins showing the cause and result of accidents and the remedy is excellent accident prevention propaganda. These need not be lengthy nor elaborate. Brief, concise and illustrated where necessary.

Fourth—the publishing of monthly scores showing the number of accidents per employee, or per 100 employees by forces is another form of maintaining the good effects already gained. This latter scheme introduces a sporting feature into the work and we find it is productive of good results for no supervisor wants to be in the limelight with a poor score.

Fifth—the development of committees whose duties comprise the reviewing of reports of accidents when they occur, preparation of educational data for the working forces, reviewing of practices and circumstances which might be productive of accidents and general supervision of the work. These committees are very important links in the organization and are clearing houses for the movement.

The future results in the development of accident prevention and first-aid in the telephone field rest to a great extent on what we shall be able to do based on our previous experience.

There is one thing certain, that is, an increased loyalty and efficiency that is difficult to measure has been obtained through our accident prevention and first-aid program. It has served to develop and broaden the forces, it has brought about through personal contact a spirit of loyalty and co-operation which is so vitally important. We have high hopes for the future and we look for a more thoughtful and careful working force and a much improved job all the way.

In connection with our first-aid work, there is a factor which is outstanding because of its unusual nature. When we planned the campaign it was specifically made clear to the employees that all of the training would be voluntary and would be on their own time. Through all sorts of winter weather, through all manner of handicaps (traveling long dis-

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tances, eating cold meals or perhaps none at all) the forces stuck to the job, with the result that although only 332 of the original registrants took the final examination, practically every one of the 600 employees who participated in the work possesses a knowledge of what to do and how to do it should the occasion demand.

CHAIRMAN MORRISON: The first discussion will be by Mr. Detwiler.

MR. A. B. DETWILER: Mr. Chairman, Mr. M. L. Rafferty of my company and myself were both scheduled to comment on this paper, and we came to an agreement, that, inasmuch as our comments are along the same lines, we would pool them, and he asked me if I would not undertake to carry his part along.

DISCUSSION OF MR. DOWNEY'S PAPER

A. B. DETWILER, DIVISION SUPERINTENDENT OF METHODS, BELL TELEPHONE COMPANY OF PENNSYLVANIA, PHILADELPHIA

Mr. Downey has pointed out the elements which are necessary, namely, the whole-hearted support and interest of the supervising and working forces, competitive first-aid demonstrations, competitive advertising among the force, etc. We can fully subscribe that all of these are essential if we hope to satisfactorily cope with our conditions. For a time, in the earlier years of our safety work, we did not sufficiently appreciate the vital importance of sifting safety from the top down, just as we proceed when we want results in any other work our organization produces.

Our superintendents and our foremen were not enthusiastic enough and did not assume their full share of responsibility in the work. When it dawned on us, however, that the man on the job responds at once to leadership in safety by the superintendent and by the foreman, while he remains indifferent to almost any amount of pressure from external sources, we realized that the main factor to the solution was in our grasp.

First-aid team work has been a very helpful factor in our safety campaign. For the past five years, competitive team work has been a leading feature, and, during the past few years, practically the entire male working force has participated in these first-aid team competitions. The fundamental purpose is, of course, the training of the individual employee to render first-aid in the event of injury to himself, his fellow employees and to the public. The only effective way to learn is by actual practice and the first-aid plan affords a practical, as well as an interesting, vehicle. First-aid training is a direct incentive toward prevention because a man who has been taught how to take care of injuries subconsciously endeavors to prevent their occurrence.

The publication of bulletins advertising accident prevention and first aid, and enlisting the aid of the men in the reporting of any conditions in the plant which might constitute accident hazards, have also been found to be most helpful agencies. Whenever such reports are received, every effort is made to get prompt action and to remedy the condition as

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quickly as possible. This frequently involves joint action with electric light or power companies and usually we get very good co-operation.

Our success in steadily reducing accidents during recent years has been most gratifying. This we attribute mainly to these three things:

First—The active personal interest of the superintendents who have sold safety to the foremen and they in turn to the individual employees.

Second—Active competition between groups and between districts, both in accident prevention and in first-aid team work.

Third—Continued and well-sustained safety activity.

These factors seem to be fundamentals in the successful working out of the safety problem in the telephone field.

MR. FISHER: We practise first-aid, but it is done through meetings of the foremen, and executives, who really handle the first-aid appliances, and they are simply taught what to do by a physician of repute in the city. We have no regular teams. This system strikes me as a very desirable thing in the telephone field, because your men are scattered, and I have been wondering how I could apply it to my own work. I am a great believer in first-aid, not only because it stops infection, but it gets your men together, and stimulates perfection as well. In all of the companies I know anything about, we feel that adequate attention to injuries is our best and greatest lever in promoting what we may call solidarity throughout the organization, and if the workmen can be made to feel that the company considers every accident, no matter how trivial, a serious thing, they will report accidents better. There will be less malingering.

PRONE PRESSURE RESUSCITATION TRAINING ONE OF MOST IMFORTANT FIRST-AID MEASURES FOR PUBLIC UTILITIES

MR. CONNER: Our company has its first-aid meetings every month except the summer months, that is at the shop meetings in which the men are all brought into the shop and are required to go through the first-aid drill for the resuscitation of persons overcome by gas. We combine accident prevention and first-aid training. We have been very successful along that line. We hold about ten meetings in each district each year.

MR. FISHER: We are now starting out to teach each individual in our employ. We have already had our first-aid meetings and resuscitation practice in groups, and we feel that has not finished the problem. We are going to take care of everybody, on the company's time, and when it is convenient for an employee, or for the foreman to allow him to do it, an instructor is going to show all the employees these things individually. I think that is going to put us on our feet 100 per cent to take care of gas asphyxiation or electric shock.

MR. MACLACHAN: In training men in resuscitation, we have found it of very great advantage to have a record of the men who attended the practice, and the dates of this practice. I find if you tell the department to have practice regularly, they will carry on for a little while, and then slack off. If you maintain an absolute record of this, I think you will

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have better and further success, and as for the success of the Schaefer method in the last year, any of us who are using the method can give you case after case of shocks resulting from contact with extremely high voltage, very successfully revived by the men long before a doctor or any other assistance can be brought on the job.

MR. LLOYD: We employ instructors in the methods of resuscitation. We have a trained man in every plant operation, a man who has demonstrated he knows just what to do, but usually we find he does not know what to do in case of accident, and so we immediately teach him. A man is not placed on the payroll until he knows the system of resuscitation. We find the system mighty good, and saved several lives last year.

MR. DOBBIN: We are paying particular attention to resuscitation, and our practice is to visit the men on the job. I have enlisted the co-operation of one of our engineering department, who is an ex-service medical corps man and I find that his instructions are every good. He takes a deep interest in the work, and the men like to have him show them.

MR. VINET: The Canadian Electric Association gives a medal to anyone performing successful resuscitation, to stimulate interest in the work.

MR. HARMER: Every graduate of the public schools of Philadelphia has been given a half-hour lecture on the prone pressure method of resuscitation. That has been carried on in the last two years. That is a result of the efforts of the men who give their time giving the talks, demonstrations, and lectures on safety. I could give you the names and the connections of many men whose lives have been saved through this means alone.

IN RESUSCITATING A VICTIM GET BUSY AT ONCE AND DON'T GIVE UP TOO SOON

DR. FRANK M. BULLOCK: Early in 1912 my people threw one of the N. E. L. A. manuals in my face and said "Go to it", and I did. I covered the whole New England territory for our people, thoroughly teaching the men in the prone pressure method, with a result that where, prior to that time, were burying our men when, unfortunately, they came in contact with high tension wires, today, time and time again, we resuscitate them. I do not know of anything that you can talk about to a bunch of men that they will appreciate any more than accident prevention and first-aid. I want to tell you about two or three cases. A number of years ago two of our line men were coming back to their station. One of the boys, Jimmie, saw a pair of wires lying down close to the road, and thinking somebody might drive into those wires, reached out and took them out of the road. Jimmie forgot that half a mile ahead of him was a twenty-three hundred electric light line. Jimmie was grounded in good shape and he went down and out. The other fellow jumped down and without a minute's pause, with nothing but the light of a lantern, he worked over Jimmie for three-quarters of an hour and brought him to. Jimmie is alive today, and out with his gang, absolutely owing his life to the fact that our men had been instructed in the prone pressure method. We had a case of a man who got up against high voltage and a doctor was near at hand and was called. He worked over the man ten minutes

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and pronounced the man dead. One of our men said, "Doctor, I do not think he is dead, we better keep on trying." The doctor said, "It is no use." "Well," the man said, "there is no objection to trying, is there?" and the doctor said "Oh, no," so they went to it and the man is living today. The Malden Electric Company had a case of a man who backed into a twenty-three thousand volt circuit two months ago. Fortunately, he had a helper who went to work on him, but it was fifteen or twenty minutes before the helper got a single response from the heart. In three-quarters of an hour he had the man breathing and brought him in to the hospital. And the man is out, nearly ready to go to work.

Our first-aid kits have been of splendid use in cutting down our poison wounds, our septic wounds. Over and over and over again our men have been able to help others (not employees) who have got hurt. We have many letters from physicians telling of the splendid results of first-aid treatment given by telephone men—and all that helps in our relations with our public.

Just one more word about the prone pressure method. Remember these two things: in the first place, it is the first five minutes that may mean the difference between life and death to a man. Every minute that you wait in order to get aid is so much against the man's recovery. The second point you want to remember is this: do not give up too soon. For example, in one case in a New Hampshire town a foreman worked on a man for two hours and three-quarters before he got a single breath, and the man is living today. Another, a case of father and son working for an electric light plant where the old gentleman got up against the wires. In spite of the fact that two doctors repeatedly pronounced the man dead, the boy, who had been instructed in the prone pressure method, worked on him for three hours and a quarter, and brought his father back to life.

In other words, gentlemen, this first-aid work offers a splendid work for all of us to develop, the men take to it, they are willing to practise, they are willing to work, and they welcome talks and that sort of thing. Every time you start in to develop your first-aid work your accidents are going to begin to come down.

INTERFERENCE DURING RESUSCITATION MUST BE PREVENTED

Mr. Penrose: We had a case of a repair man in one of the sub-stations, who while putting up temporary service came in contact with a disconnecting switch which carried forty-four hundred volts, the man was knocked ten feet to the ground, and the men who were working in the vicinity immediately started prone pressure resuscitation. Some of the other men also sent for a doctor. In the meantime they had been restoring this man through the prone pressure method, and I think got him to the point of breathing, in fact we expected him to come back to consciousness any minute. The doctor immediately pushed the man off who was working on him and started to take his pulse, and general examination. The result was the man died. About a year ago we had a similar case, a man working on a pair of secondaries at the top of a

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thirty-five foot pole came in contact with lines from which the insulation was worn. He was thrown to the ground and they also worked over him and had him breathing, and due to the interference of the doctor, that man also died, but the doctor reported the man died of a broken neck. We took this matter up with the public utility commission of the state, and at the present time we are trying to overcome the situation. We find the ordinary doctor does not understand artificial respiration, or the pulmotor, and our men put more reliance in artificial respiration than they do in the pulmotor.

MR. RINKE: I have heard of so many cases where there is interference by the police physicians, I am wondering if a committee could not be appointed to confer with the N. L. A. and other organizations to see whether light cannot be brought on this subject for the physicians through the medium of medical training and so forth.

MR. MACLACHLAN: I might throw some light on that matter. The Conference of Industrial Physicians and Surgeons has a committee under the chairmanship of Dr. Lauffer dealing with publicity for the prone pressure method. At their annual meeting in Boston last May the matter was taken up and I feel sure that more publicity, particularly in professional journals will be given in the future.

MR. RINKE: Would it not be a wise move to send out a questionnaire to the utility companies to get their experience along those lines, possibly successful cases and cases that were not successful, due to interference, as ammunition for that committee?

MR. GATES: I do not believe we need to wait for the doctors to take action. All that is necessary is for the companies to issue orders to their men, that they are not to stop the prone pressure method of resuscitation until the company physician pronounces the man dead. We have resorted to that method to stop the interference that has been mentioned here this morning, and we found the method we adopted has been satisfactory. The fire department in Chicago practised the prone pressure method of resuscitation every day, and usually in the case of electric shock, or asphyxiation from gas, the firemen are on the job, and you can depend on them to keep any outside doctor from interfering with the men while they are working on the man. In one case two of the gas company's men were overcome, there was no one at the job and someone dragged them out of the man hole, laid them on the sidewalk for dead, and the policeman called the ambulance. One of our gangs was working near this location, and they were called over. They started working on the men and a physician insisted on loading these men into the ambulance and taking them to the hospital, but fortunately another doctor arrived about that time and insisted that our men be allowed to work on them. Both of them were brought to, and they are living today. We have many similar cases of our men saving people who are overcome by gas, and occasionally people who are apparently drowned. There is no question but this method, the prone method of resuscitation should be taught to every member of a force of men engaged in a line of work that is at all

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hazardous. It should not be limited to people who are engaged in that work, it should be extended to the office force.

CHAIRMAN MORRISON: The next paper is by Mr. Maclachlan.

THE USE OF PROTECTIVE DEVICES

WILLS MACLACHLAN, CONSULTING ENGINEER, TORONTO, CANADA

In dealing with the question of the use of protective devices I was tempted to take the matter up from a purely engineering standpoint, and show you a number of different protective devices and the use of them, but I know you have all got a great number of protective devices and no doubt you have better than I can put before you, but I think that possibly the other side of the question has not been emphasized as it should be,—I refer to the use more than the design of the protective device.

Taking up certain typical circumstances in connection with it, I would like to deal first with the question, the lack of use of the protective device. About two years ago they were repairing a transformer in a town in Ontario, and had the transformer in place and were finishing taps. Another line man came along and climbed up the pole to take off the tackle from the top of the pole that had been used in raising the transformer. He had left off his rubber gloves and had left off his belt. In passing the transformer he came in contact with one of the joints and received a shock. The man on the pole reached over and grabbed him, but in so doing he pulled the cuff of the glove down very far and received contact above the cuff of the glove, and received a shock, and fell back into his belt, the first man falling to the pavement. Both men were immediately resuscitated and brought around, the first man received, practically speaking, the same shock as the second man, but he died about six hours later from a broken neck. In one case the man was using the protective device, and in the other case the man was not using it. Another situation is the case of a guard around a gear. In repairing the gear the guard was removed, and, as often happens it was not returned. A young chap went down to feel the bearing on the governor drive gear on a vertical turbine, he was drawn into the gear, and his head and shoulders severed from the body. Lack of the use of the guard!

In connection with the misuse of these protective devices, I have in mind a wooden-rubber combination mat that we use in the back of switchboards. Just recently I have been over a number of substations and power stations. The proper way to use this combination mat is to have the rubber mat down on the floor and the wood on top of it.

RUBBER GLOVES SHOULD BE TESTED REGULARLY

In going over a number of cases of gloves, we find that they are not maintained in the way they should be. The rubber glove may be perfectly O. K. when it goes into service, but if it is not regularly tested and kept in good condition, it is a very poor thing for the lineman to use. Any one of you can go into the stations and I have no doubt you will find rubber gloves which have lost all their elasticity, and if you put them

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on a test bench you will find they are porous or will not stand up. Maintenance of these protective devices is extremely important.

Dealing with the question of design. I think most of us have been using a grounding chain in grounding high tension transmission lines. I remember well a case some three years ago in which grounding chains were used for protection of a gang of linemen changing over a temporary connection on a high tension line. Through some mistake of an outsider, a switch was thrown and the line made alive. The grounding chain did not protect the men, they were both killed. We have replaced almost entirely the grounding chain by grounding clamps and flexible wire leads between these clamps. In connection with design, I think we need to use quite a bit of care.

What is the employees' attitude to these different protective devices that we provide? The first is that the protective device is for the greenhorn. You know the trouble we had in making the linemen wear the pole belt attached to their tool belt. "A lineman who was a lineman at all could climb the pole and put his leg around and carry on." Let them get a static shock in that position and you know where they are going to land. That is the position in which employees put practically every new device that comes out. It is for the greenhorn. When we can show him, he will see it quickly enough because he does not want to get hurt any more than we do. But his first attitude is "It is for the greenhorn." All of us have found, I am sure, a difficulty in getting linemen who have not been used to using rubber gloves, to use them. They claim they impede their work. After sufficient training with well designed gloves, it has been found, however, that the work can be carried out with sufficient speed and with greater protection to the men. One of the difficulties that we have to overcome is the claim on the part of the men that protective devices impede the work. I do not know how many of you have talked over with the men on the job the question of receiving a shock by standing on ground and touching a live wire. They do not understand that hazard. They do not understand they are getting between the two wires. They may know it is dangerous to stand on ground and touch a wire, but they do not understand the hazard back of it, and I think we have not emphasized nor instructed the man enough in the fundamentals of these hazards. We understand it as we have had preliminary training of a technical nature and it has prepared us for it, but I think the average man has not had that advantage. At least I find a number of men who did not understand the fundamentals of the hazards they were dealing with.

Another point is that they are not trained in the use of these different devices. You know as well as I do that habit makes up a great proportion of our lives. We do things automatically without thinking, possibly. Cannot we get the men on the job to do these things through habit of doing it and almost automatically, using these various protective devices?

EMPLOYEES MUST BE IMPRESSED WITH IMPORTANCE OF PROTECTIVE DEVICES

What is the employer's responsibility in connection with the use of protective devices? I think the first thing that he must realize is that

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the protective device is part of the equipment, and it is not a frill attached to that equipment. Take the question of a governor on a hydro-electric turbine today. The fly ball is covered, which makes a better equipment, it works better, and the men are not getting hit on the head with the fly ball or having their elbows hurt. It is part of the equipment, you do not look on that fly ball cover as a protective device, but a short time ago it was only a protective device.

We take a pair of rubber gloves or a bucket for raising or lowering tools, or some other different device and put it up for use. Do we send explicit instructions into the field with that device? I do not think we do, in general. We have developed the whole thing, we know exactly how it is going to work, but the man on the job does not know, and how can he know? He is not a mind reader and the employer or the manager should put very explicit instructions into the field along with these various protective devices that they are instituting or putting into service. That is hardly enough, for it is necessary to train the men in the use of these devices. When a device is new the men do not know how to use it, and they should be trained in that use. If you get out instructions about using protective devices you should have also explicit instructions to the foreman telling when they are to be used. These instructions ought to go into the rules and should be definite. The foremen should be made more or less responsible, or at least answerable for the use of protective devices. They are the men's leaders, and if the foreman does not believe in them, the men are not going to use them.

THE ENGINEER'S RESPONSIBILITY IN ACCIDENT PREVENTION

What is the engineer's responsibility in connection with the whole matter? I am taking a chance in telling a story to you in this regard. Within the month I was attending a banquet held in New York State at which a state commissioner of labor (not of New York) was speaking particularly in reference to efficiency experts and men dealing with improving conditions in industries. He said, "Protect me from the safety engineer." He said it reminded him of a Welsh rabbit, which is neither Welsh nor a rabbit, but a piece of cheese. He said the safety engineer was neither an engineer nor was he safe, he did not complete his sentence. I think that is an absolute challenge and I do not think the fault is with the commissioner of labor, I think the fault is entirely with ourselves. If it is possible for any public man to refer to a body of men in that way, there must be some reason back of it. I think that an engineer is an engineer, and there are only two ways of becoming one, one is by the technical training given by the colleges supplemented by a practical experience in the shop, and the other is by a long experience in the shop or in the field, but it is absolutely necessary for that man to get the technical attitude of the engineer. It is also necessary for him to have the technical attitude toward the prevention of accidents to become a safety engineer. I think too few of us have taken the practical end of it seriously. For some of the younger engineers that are going into the

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question of accident prevention, I think the period between the class and the office is too short. There should be a longer time spent in the field.

Granting that the commissioner of labor may have been partly correct in his statement, yet like most half truths it is rather a dangerous one for any public man to use. I feel that there are many fully qualified engineers who find just as much scope for their professional training in dealing with the human element of engineering as do their brother engineers in dealing with the material side.

It is absolutely necessary of course, to have good design in the matter of any protective device. It must be well designed or it will not be used, and it is up to the engineer in designing it to see that the protective device is of good design. Then, he should be the one beyond all others to see that the instructions for use are correct. They may be worked out in collaboration with others, but if that piece of apparatus or protective device is not going to be used in accordance with his ideas, then the device will have to be changed to meet the obstacles that will certainly develop in practice.

To sum up, there are just one or two points I wish to bring out. I do not think the great need at the present time is for a great number of new protective devices. I think the more need is for well designed simple devices that will be used. If we get these few simple devices well designed and in the field in use, we will go further than we will by designing a great number of new schemes. Another thing that is possibly branching from the question of protective devices is the necessity for constructive training of workmen and not haphazard picking up. That may be verging on the question of labor turnover but it is well known that with low turnover we are getting a low number of accidents and I do not think enough attention has been paid in the past, in the great bulk of the companies, to the training of the men, trying to develop the men who will stay with you a long time and keep them well trained. We have been overworking our employment managers and not working at all, or underworking, our instructors.

DISCUSSION

Chairman Morrison: The discussion of this very able paper paper will be opened by Mr. E. R. Dobbin, Empire Gas & Electric Company, Geneva, New York.

Mr. Dobbin: Lately I have been quite disturbed by the number of slight injuries due to the "lack of use" of protective devices provided. This applies especially to goggles by our oven men, to respirators by our ammonia still operators, and to flashlights by our meter readers. The men did not take the time to protect themselves because the job would take only a minute or two and there appeared to be little or no danger—and there was no foreman around to remind them that protective devices are provided to use and not as mere ornaments. I find that these little jobs contribute quite as many accidents—as our big jobs—for a big job is planned and safety is part of the planning, while a small job is done on the spur of the moment and often while the foreman is absent.

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It has been well said that the use of devices provided is largely a matter of education and training and habit. I feel that every safety manager believes that and further that he believes the foreman is the one we must look to to back up the training. If the foreman becomes indifferent—his men become indifferent and accidents begin to happen again. The knowledge due to the training is there but the leadership is lacking.

In my opinion the teaching of individual carefulness whether using protective devices or not is one of the big things to be thought and preached and insisted upon. You have heard the expression that "the best safety device is a careful man". I believe that that is true and our men are being taught to be *careful always—first and last and in between times.*

Emergencies call sometimes for chance taking but it is strictly up to the foreman to reduce those chances to a minimum by thinking quickly as to what to do and how to do it in the safest manner possible or in other words "to use his brains and his training at the same time and make that time short."

Every public utility management should insist upon the teaching and practice of the prone pressure method of resuscitation. This method is easy to learn and easy to teach and its use as a protective method against death by shock or gassing should be more appreciated than it is. Its use by our own men has saved at least two lives so far this year—one case being especially interesting due to the fact that the method was used at once and on a sloping substation roof while a doctor and a noisy crowd were insisting that the man be brought to the ground. This was a 33,000 volt shock case and the man was apparently lifeless. But inside of 30 minutes—breathing was restored and the man taken to the ground and turned over to the doctor for burn treatment. The foreman was confident in his own ability to use the prone pressure method and felt that the delay of taking the man to the ground would probably mean failure to resuscitate. He simply thought and acted quickly and used the protective method against death as he had been taught to do.

I am much interested in studying the results of a 10 hour study lecture course entitled "Serving the Public" in which every member of our organization was schooled last winter. The ten books were written by our vice-president assisted by a noted lecturer and dip a little into the rudiments of psychology and the training of the mind with the fundamental idea of rendering better service to each other and to the public. Results have been satisfactory from a service rendering viewpoint and I feel that the opening up of the thinking facilities of the mind of our employees due to this teaching has indirectly been of great assistance in accident prevention work. There is no doubt but that "thinking men are safer men than thoughtless men" and I know that our men are thinking more and better than a year ago and I'm giving this course some credit for the improvement—the effects of which I notice in my work.

Mr. Detwiler: It was quite a while before we got our line crews in the frame of mind to make rubber gloves a part of their regular working equipment and to use them when they should. Also, we have reduced the hazard in outside plants which require the use of these protective

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devices. It has not been our experience that a man will regard these devices as something merely for the greenhorn.

MR. LOVERING: Mr. Maclachlan mentioned the inspection of rubber gloves. I would like to ask him how he determines in his company whether the test is mechanical, electric or both, and what success they have had.

MR. MACLACHLAN: I do not happen to be with any one company, but am in private practice. The accepted standard is the N. E. L. A. test, ten thousand volts for one minute, with a certain pair of gloves taken out of each batch for test.

CHAIRMAN MORRISON: We will have the next paper by Mr. Gates.

CARE IN THE CONSTRUCTION AND MAINTENANCE OF OVERHEAD LINES

A. B. GATES, SUPERINTENDENT OF OVERHEAD LINES, COMMONWEALTH EDISON COMPANY, CHICAGO, ILL.

Overhead line construction and maintenance work can be made safe only if the equipment is properly designed, safe working methods are followed, and every workman has the proper attitude toward safety work.

In the early days lines were not designed, they were simply built. Every gang had its own working methods and the management did not furnish rubber gloves or other protective equipment because the necessity of such equipment was not recognized. Linemen accepted conditions as they found them and the majority were of the type who boasted, "We eat the hot stuff alive," and were quite largely of the opinion that unless they were careless enough to assume that attitude they would not be considered linemen by their fellow-workmen or by their employers.

But changing times have changed conditions and for years those interested in safety work have realized that the responsibility for safe practices rests more heavily on the management than on the workmen. We find that overhead line structures are now being designed with considerable thought as to the safety of the workmen, safe working methods are being established, and every effort is being made to insure a proper attitude on the part of the linemen toward safety work.

DESIGN OF EQUIPMENT

The first consideration should and must be the strength of the structure. It must have a sufficient factor of safety to withstand any stress to which it may reasonably be expected to be subjected, and second, but of equal if not greater importance, it must be simple and so arranged that the conductors and equipment may be supported in such a manner that the workmen can ascend or descend the pole or structure without danger of accidentally coming into contact with the live conductors or equipment.

All conducting material, such as braces, transformer cases, bolts and guys not permanently and intentionally grounded, must be installed so as not to be in contact with grounded or live wires. The climbing space

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must always be kept clear of guy wires, live or grounded wires, as well as cable lateral pipes, transformer cases or other equipment.

The company with which I am connected has for some time designed and built its overhead line structures in accordance with the principles above outlined.

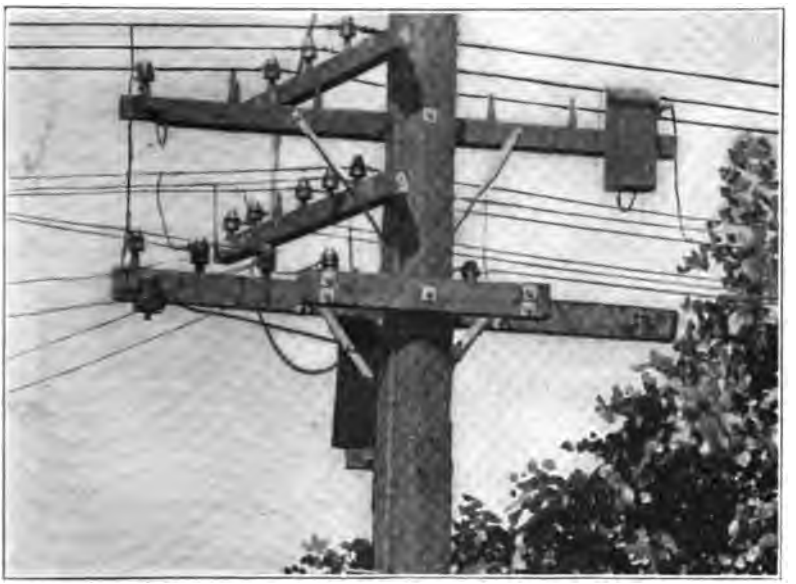

FIGURE I

Figure I represents a single lighting transformer installation with line wires supported on side or alley arms. The 2,300 volt primary wires have been shaded in the photograph so that they can be more readily distinguished from the secondary wires.

It should be noted that the transformer is installed on the second buck arm, the transformer primary leads or jumpers are trained out at the end of the arm and primary cutouts are installed at or near the end of the second buck arm. The service wires leading to the adjacent houses are supported on the second buck arm between the primary jumpers and pole, and the lightning arresters are installed on the top buck arm so that only short leads are required.

With this type of open construction the lineman in working on the primary wires on the alley arm need not contend with the lightning arresters and the troubleman or lineman in replacing primary fuses need not climb through a congestion of wires but can reach these cutouts from below while in a position in which he is entirely clear from live wires and other conducting material.

Figure II represents the installation of three power transformers

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FIGURE II

hung on an arm and Figure III represents an installation of larger transformers on a platform.

In both of these installations the same principle is applied. The transformers, primary cutouts and arresters are so located that they can be

FIGURE III

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'eached for inspection or replacement without endangering the lives of he workmen.

Figure IV represents a cable pole with the disconnecting potheads nounted on a buck arm. Below this buck arm is a standing or guard ırm on which the lineman or troubleman stands while operating the

FIGURE IV

lisconnecting potheads. The lead cable leading into the pothead is ›rought up in an iron pipe to a point about 10 inches above the standing ırm and from this point it is trained over to the pothead.

The lightning arresters are installed on the alley arm so as to give nore clearance for operating the potheads. If secondary services were o be taken from this pole they would be supported on a buck arm below he standing arm so that the lineman could not come in contact with hem while operating the potheads.

Figure V represents a cable pole of the same general design as that ›hown in Figure IV with the exception of the use of four conductors in-:tead of single conductor disconnecting potheads.

Figures I, II, IV, and V, represent structures on which the line wires ıre supported on side or alley arms. With line wire supported on cross ırms it would be a little more difficult, especially in the case of the cable ›ole, to provide as clear a climbing space. But by spreading the line ;vires on the poles on which a considerable amount of operating is likely :o be necessary and possibly by increasing the height of pole used, satis-:actory clearance can be obtained. In some cases safe climbing and working space is provided by the use of insulated wires or cables.

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SAFE WORKING METHODS

The most essential contribution to safe working methods in line work as in all mechanical trades, is satisfactory tools and equipment in first class condition. Rope must be free from metal strands and when it becomes worn it must be replaced. Cutting tools must be sharp and provided with suitable handles or holders, chisels, bars, wedges, hammers and star drills must be faced and free from mushroomed heads. Wrenches

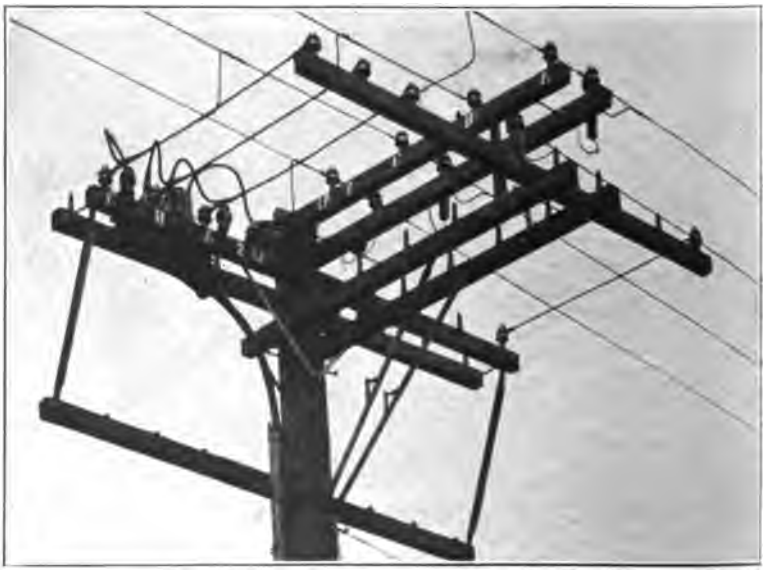

FIGURE V

must be carefully inspected and repaired or junked when the jaws become worn or sprung.

Every workman who is required to work on or near live wires should be provided with rubber gloves, and every crew should be provided with a sufficient number of insulating covers, so that all live or grounded wires or conducting material, with which the workmen can possibly come in contact while working on or near live primaries, can be covered.

As far as possible methods of doing standard work should be systematized and working rules should be established so as to insure uniform practice in all gangs. In addition to the working rules or standards a complete set of safety rules should be established, and kept up to date and enforced.

All conductors not known to be dead should be considered alive and when men are working on or near live wires all other conducting material with which the workman may come in contact should be covered. No workman should be allowed to handle live conductors with only rubber gloves as protection on circuits of over 4,000 volts. If overhead line

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repair or construction work is to be done on live lines of over 4,000 volts high tension tools of proper and safe design should be used.

Whenever a high voltage line is killed to be worked on it should be grounded before it is turned over to the line crew and in addition the line crew should put a ground on the line, by means of a chain attached to the ground wire if there is one on the structure or to a pipe or rod ground if no ground wire is available, between the point at which work is to be done and all sources of feed or back feed to that portion of the line. The temporary ground should not be removed until all work at that location is completed.

Whenever possible all circuits and lines should be killed while they are being repaired. In many cases the saving in labor effected by doing the work on dead equipment will more than offset the trouble and expense of taking the equipment out of service, and when the reduction of hazard is considered, usually the decision can readily be made in favor of dead work.

On our system the customers who are supplied from higher voltage lines, that is 9,000 volts and above, are practically all provided with more than one source of supply so that we have not found it necessary to use high tension tools for making line repairs, as usually we have no difficulty in taking a line out of service.

FIGURE VI

For distribution work we have found on our system that a rubber blanket about 3 ft. square provided with three eyelets along two of its edges and 3 or 4 ft. lengths of ¾ in. garden hose provides the best protection possible while doing live work. As illustrated in Figure VI the blanket is used to cover wires on insulators, transformer cases and other

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equipment, and wires when workmen are working above them. The hose is used to cover wires when the workmen are reaching around or under them and for jumpers or leads that cannot be readily covered with blankets.

Rubber gloves which have been tested for puncture at 5,000 volts are supplied to all workmen who have occasion to work on or near primary wires. These rubber gloves are always worn under a horse-hide glove which has a complete palm, thumb and fingers, but has the back removed. The horse-hide glove is short, coming only to the wrist, and is held in place by a wrist strap.

For work in rainy or stormy weather all men who are required to do emergency work are provided with rubber coats and three-quarter length or sporting boots.

Our workmen are required to test their gloves by the air pressure method each time before putting them on and the foreman examines all rubber goods, other protective devices and tools at least once each week and in addition a monthly inspection is made by the safety inspector.

With all precautions taken, accidents may happen through man failure or other causes. And to be sure that we will be prepared to meet such an emergency if it occurs, every member of the overhead line force is required to practice the prone method of resuscitation each week.

DISCUSSION

Mr. Reid: When work began some seven or eight years ago, the very first meeting that was held came very near ending up in a riot, and the reason for that was that the men did not understand just what the company was trying to do, there was more or less suspicion that the Commonwealth Edison Company was trying to put something over on the workmen. I remember particularly one of the overhead divisions where that feeling was present. I also remember upwards of three years afterwards I attended a meeting of that same division and I could not help but note the change in the attitude of the men. They had found out by that time that the company was willing to listen to any suggestions they might have to offer with respect to the physical conditions of the property, and I think up to this time they have made some two thousand recommendations. I do not recall that there has been any great amount of dissatisfaction on the part of men who offer suggestions that were turned down for various reasons. The manner of handling those might well deserve the careful consideration of those companies which are inviting suggestions from their men and are called upon to dispose of them in one way or the other. The suggestions are referred to a special committee to make investigation. Then, if necessary, they go to an intermediate committee, and it frequently happens some of them get to what is known as the executive committee.

There have been a few instances in which recommendations were turned down, and they seemed to be of such importance to the man who made them that they were put through again. I recall several instances in which the recommendations were submitted again and were passed

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upon favorably. I do not know of any organization (and I have come in touch with a good many) where the feeling with respect to the attitude of the company is just what it is in the Commonwealth Edison Company, and I am persuaded that the reason for that is that practically every man knows just exactly what the company is trying to do.

I think too much stress cannot be placed upon supervision. That is one of the things that that company has insisted upon. Another thing not mentioned by Mr. Gates, that I think it would be proper for every person here to consider, is that when an accident happens the man who is in charge of the gang is immediately taken out of service. An investigation is made, not a superficial investigation, but an honest investigation that investigates, and if it is found that the foreman is responsible for the accident he may be disciplined by being removed entirely from the service, or he may be given a thirty day vacation without pay. If it is found he was in no way responsible, then, of course, he is put back on the job without any loss of his time.

MR. MILLIKEN: I think this section should make some recommendation to the National Safety Council. Anybody that has had anything to do with teaching the prone pressure method of resuscitation knows there is always a confusion of ideas which militates against its successful application in case of a real victim to be resuscitated.

Nearly everybody believes the Schaefer method as recommended by the N. E. L. A. is right. If that is so, it seems to me it should be used in all industries, not only the electric industry and the gas industry, but all other industries involving similar hazards. Even in a sand pit a man may be caught and covered up and have to be resuscitated.

MR. GEORGE OLIVER SMITH: I found at least twenty-six different methods of applying the Schaefer method. I think that until the matter is passed upon by the Bureau of Standards in Washington that this is taking a step just a little premature. Further, the question of the Schaefer method, the efficiency of the Schaefer method, has not been determined by the highest authorities.

MR. MACLACHLAN: I feel that Mr. Smith's remarks should not go unchallenged. He has given the impression that the prone pressure method has not received the approval of the highest competent authorities in the United States. The Third Resuscitation Commission which passed upon this method and approved it, was under the chairmanship of the late Dr. Meltzer of the Rockefeller Institute of New York and was composed of the professors in physiology of your leading universities, the surgeon general of the army, navy and ordnance, with three of the most prominent electrical engineers in the United States. This is a fairly strong body, rather unbiased and their advice might be taken with something more than cursory interest.

MR. REID: I would certainly have no objections to the Bureau of Standards taking this question up and standardizing it. I think it ought to be standardized by somebody who would have authority to do that.

Now whether this matter is standardized by the Bureau of Standards or by some other body, I think it behooves the utilities people in the meantime to stick to the method that has been recommended by the National

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Electric Light Association. I am not sure that the Bureau of Standards or any other body of men in this country would be any more competent to pass upon this question than was the body of men composing the Third Resuscitation Commission.

(A motion was made and carried that the subject be referred to the Bureau of Standards.)

MR. LLOYD: I am very glad to see this subject of overhead lines being taken up, because I feel it is one that has been too much neglected in the past. The author of the paper, in stating the underlying principles of the necessity of providing climbing places on the pole, that is one that is easy to take care of in the simplest cases but it is not so easy to take care of when you get to a pole with buck arms on it, and in much of the construction now existing, it has not been taken care of. That particular item needs very careful attention in the design of future construction. In Chicago, as we saw in some of the illustrations here, a good bit of the lines are run through alleys where side arm construction is used. That leaves, in a simple case, one side of the pole free and you can put on your buck arm without obstructing the climbing space. Where the ordinary arm is used, that is not true, and special care needs to be taken to maintain a climbing space of adequate dimensions in two directions for the men to climb through. Another way of meeting the problem is, when you come to set the poles, to omit on one side of the pole the use of the end pin, or possibly next pin, and spread your wires. If all of the spaces are occupied, that will probably mean using the entire arm.

MR. GATES: In Chicago we have very little chance for such construction, we have a few cases where lines run on private property, a few other extensions into large plants. We have used longer arms and of course, in those cases there would not be very many circuits on those poles, so it is very easy for us to push our wires out on the pole and get the necessary space to make climbing safe. Transmission work, of course, is all cross arm, but that work is all done dead, and the clearance does not cut quite so much figure. We get sufficient clearance to be safe while working.

MR. FISHER: I want to tell you one move our company has made. The general manager, as a matter of efficiency pure and simple, has instituted a departmental meeting, once a month, presided over by the foreman in charge. They discuss matters of economy and safety, and it gives the safety engineer a chance to get in there once a month and give a little instructional talk, where in a set meeting he could not get by.

MR. OPP: I am wondering if any concern here represented has gone into the matter of belt testing with the application of dead weight and light weight in the test?

MR. MACLACHLAN: You will find that in the last report of the last meeting of the N. E. L. A.—specifications for belts and for testing. Some of the companies represented on the committee have tried it out themselves with very good results.

ADJOURNMENT.

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Rubber Section

September 27-30, 1921

E. H. FITZGERALD, Chairman
Federal Rubber Company, Cudahy, Wis.

E. W. BECK, Vice-Chairman
United States Rubber Company, New York City

RAY N. WATSON, Secretary
Goodyear Tire and Rubber Company, Akron, Ohio

TUESDAY MORNING SESSION

THE meeting was called to order by Chairman Fitzgerald.

CHAIRMAN FITZGERALD: The first paper on the program is by Mr. Watson, who is unable to be present. His paper will be read by Mr. S. M. Schott, of the United States Rubber Company.

STANDARD STATISTICS FOR THE RUBBER INDUSTRY

RAY N. WATSON, GOODYEAR TIRE AND RUBBER COMPANY, AKRON, OHIO

At the Ninth Annual Safety Congress at Milwaukee the Rubber Section decided to tabulate the accident experience of the members of the section so that we might compare our frequency and severity rates with the rates for other industries and also give each company the opportunity to see how their individual experience compared with the experience of other members of the section. To facilitate the preparation of these statistics so that every company would use the same basis for the preparation of their figures, standard rules were formulated and standard charts were printed. The standards adopted conform to those suggested by the National Safety Council and other authorities on accident statistics.

Accident summary and accident cause classification sheets with the standard rules and definitions on the reverse side were sent to all members of the Rubber Section, but due to the fact that most companies were curtailing expenses wherever possible, replies were received from only ten different companies. These companies, however, operate forty-two factories so that the figures should be fairly representative.

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The chart shows the standing of the companies arranged in the order of their severity rate, as this rate influences the accident cost more than frequency. It will, however, be noticed that the frequency very nearly follows the severity.

AVERAGE LOST TIME 1.57 DAYS PER MAN PER YEAR

The severity rate for all factories reporting shows an equivalent of .65 days lost for each 1,000 hours worked. Figuring that there are 300 working days of eight hours each in a year, this would show a lost time equivalent of 1.57 days for each man working a full year. Seven of the ten companies reporting had a lower severity rate than the average of .65.

Analyzing the frequency rate we find that the companies reporting employing approximately 28,000 men worked a total of 35,592,000 hours during the first six months of 1921 and experienced 884 lost time accidents which gives a frequency rate of 24.8 accidents for each million hours worked. This means that one man out of every 17 employed would be injured in the course of a year.

Combining the frequency rate and the severity rate, if all of the time lost is divided among the injured men, one man out of every 17 would lose 26.4 days during the year due to accidents.

The classification of accidents by causes should have been submitted on two separate sheets, one showing the classification of "time lost" accidents and the other showing the "no time lost" accidents. However, very few companies did this, so that I have thrown the figures all together on one sheet. Next year I should like very much to see these figures submitted separately so that it will be possible to show what accidents are running up the severity rate and causing lost time and suffering as well as those that merely cause loss of production by causing the injured man to visit the hospital for treatment without further loss of time.

CAUSES OF ACCIDENTS, JANUARY 1 to JULY 1, 1921

Machine Accidents

Mills, refiners, washers	[illegible]
Calenders	[illegible]
Conveyors	[illegible]
Elevators	[illegible]
Gears	[illegible]
Belts	[illegible]
Hoist equipment, chainfalls	[illegible]
Vulcanizing apparatus	[illegible]
Tire building machines	[illegible]
Other machines	[illegible]
Cleaning and repairing	[illegible]
Sewing machines	[illegible]
Total	1,5[illegible]

Tools and Accessories

Molds	[illegible]
Cores	[illegible]
Awls and picks	[illegible]
Knives and shears	[illegible]
Other tools	1,[illegible]
Defective tools	[illegible]
Hammers and wrenches	[illegible]
Total	3,[illegible]

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Burns

Heaters, presses, pipes	275
Electric	9
Friction	26
Volatile liquids	76
Miscellaneous	192
Total	578

Eye Accidents

Grinding	69
Chipping, drilling	84
Other foreign bodies	736
Total	889

Falls

On the level, tripping	89
On the level, slipping	84
Stairs	6
Scaffolds, high places	46
Ladders	17
Total	242

Miscellaneous Accidents

Stripping tires	142
Finishing tires	154
Handling tires	190
Handling other material	2,961
Falling material	357
Traffic, trucking, etc.	290
Wire cuts, scratches	306
Industrial poisons	18
Nail accidents	416
Slivers	141
Unclassified	678
Total	5,647
Grand total accidents	12,289

These figures show that the causes are divided as follows:

Handling tires and material	31.0%
Hand tools and accessories	30.0%
Machine accidents	10.0%
Eye accidents	7.2%
Wire cuts, scratches, nails	7.0%
Burns	4.7%
Falls	2.0%
Miscellaneous	8.1%

This classification shows that during the coming year our bulletin and educational material can profitably be directed toward the elimination of knife, shear and small tool accidents, and also toward the safer handling of material. These two classifications caused over 60 per cent of the accidents reported. Knives and shears alone caused 17 per cent.

The percentage of machine accidents is low as compared with other industries. This may not only be due to proper guarding of the machinery, but to the fact that the majority of operations are hand operations. This also accounts for the high percentage of hand tool accidents. Chart "B" shows the detailed classification, but is not divided by companies because even though a key number was used the figures of the two largest companies would have been very evident.

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HOW TO COMPILE ACCIDENT RECORDS

Since many of the companies were unable to fill out the charts correctly and several felt that a great deal of expense would be entailed in their preparation I feel that a brief explanation is required to supplement the definitions and rules found on the back of the charts. The accident summary chart for the purpose of comparison in the Rubber Section should not be made out by departments but for the plant as a whole by months. The number of 1,000 hours worked is the total number of hours worked by the whole plant including all departments whether they had accidents or not. The next section headed "number of accidents" is simply a classification of the number of accidents according to the various headings. Under the section headed "number of days lost" the numbers entered under the various subdivisions should be the number of *days lost* due to "permanent total," "permanent partial," and "temporary disabilities." In the case of 'permanent total" and "permanent partial" disabilities the number of days should be the equivalent number of days obtained from the "scale of time losses" adopted by the International Association of Industrial Accident Boards and Commissions, the United States Bureau of Labor Statistics, and the National Safety Council.

The frequency rate is obtained by dividing the number of lost time accidents by the number of million hours worked—which is the amount shown in the second column divided by 1,000. This rate for the rubber industry should be between 20 and 50. If it is outside of that range there is probably something wrong with the method of computation.

The severity rate is obtained by dividing the total number of days by the number of 1,000 hours worked as shown in second column; this figure will probably be between .2 and 2.0.

The classification by causes is easily handled and should be made out separately for "lost time" and "no time lost" accidents.

These statistics will not be of any great value or interest nor will they create any spirit of friendly rivalry unless a great many more companies send in their figures. Since the forms are printed and the method of tabulation seems to be agreeable to everyone, I suggest that the new chairman of the statistics committee start immediately to collect figures for three months periods starting with July 1, 1921, and collect them up to July 1 next year, so that figures for a whole year may be presented at the next annual meeting. The results of each three months period should be published in the *National Safety News*, using key numbers to designate the companies, the key numbers of each company to be conveyed to it by letter. This will stimulate rivalry and I am sure will show that the rubber industry is a safe place to work.

CHAIRMAN FITZGERALD: I think it would be advisable to put off discussion on this report until the last day of the session because there is so much to go over that you may wish to study a little bit before discussing it. I will now introduce to you Mr. Hoxie, who is next on the program.

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FIRE HAZARD OF RUBBER FACTORIES DEPENDENT ON HUMIDITY

F. J. Hoxie, Engineer, Associated Factory Mutual Insurance Companies, Boston

Several years ago I visited a rubber factory where there had been a series of fires at the spreaders. The cement used was mixed with benzole and very thin. The weather was cold, the atmosphere was therefore dry. The foreman of the spreader room had dry skin and therefore could hold an electric charge for a long time as he did not give out moisture enough to locally humidify the air about his body. Whenever he brought his hand near the spread fabric on a cold day, a spark jumped from his fingers and frequently caused a fire. He was unaware of the spark or the atmospheric condition which caused it, but he was quite sure that fires were following him about in a mysterious manner and at the time of my visit this knowledge had brought about in him an unpleasant, nervous condition. He had tried all common remedies, such as working with all doors and windows open, and a part of the galvanized iron roof of the spreader building had been removed to secure the best possible ventilation. While this removed some of the combustible vapors it also removed the moisture, making conditions worse.

I suggested that some petcocks be put on the steam radiators, and that they be allowed to blow steam into the air. I then took a piece of worsted yarn, about eighteen inches long and held it over the cloth in front of the spreader knife.

Before the steam jets were put in operation it pointed rigidly at the charge on the fabric coming off the machine. When the atmosphere had been moistened by the steam the yarn hung limp. A wet and dry bulb thermometer was then placed in the room and by this instrument the amount of moisture in the atmosphere was shown. It was evident that when the atmospheric moisture dropped much below four grains of water per cubic foot of air, a charge appeared on the cloth. The fact that not only the moisture in the air but the speed of the spreader had a direct bearing on the magnitude of the charge, was apparent; moreover, cloth passed over the spreader with no rubber applied could be shown to have an electric charge the same as the cement treated cloth, but in this case no fires resulted as there was no combustible solvent present to be ignited by the small spark.

DEFICIENCY IN ATMOSPHERIC HUMIDITY CAUSES 75 PER CENT OF RUBBER FACTORY FIRES

I had previously shown in a paper given to the National Association of Cotton Manufacturers in September, 1916, that a considerable number of the cotton picker fires follow the atmospheric humidity curve, there being more in the winter when the atmosphere is dry.

Three-quarters of the rubber factory fires are caused by deficiency in atmospheric humidity as shown by the fire records of the time of year at

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which they occur. About 15 per cent of the cotton picker fires can be similarly attributed to this cause.

In both cotton and rubber manufacture the quality of goods can doubtless be improved by avoiding conditions of dryness sufficient to cause fires. This fact will serve as a sufficient motive to induce the progressive manufacturer to study his product with reference to weather conditions. By such studies, not only will the product be improved, but the hazard reduced.

Much of the safety literature leaves the impression that the chief object of such studies is altruistic and humanitarian, that virtue must be its own reward, but observation will show that the careless or ignorant persons who cause fires or personal injury, also cause loss of dollars long before the other results.

It will be of interest to study practical operating conditions with reference to the frequency of fires, and in many cases it will be found that conditions which cause fires, produce defective goods and a smaller production.

The study of the smallest details of manufacturing operations has become necessary. Safety engineering is not an independent branch of social science, but is closely associated with efficiency engineering and is being contributed to by the constantly increasing number of research laboratories maintained by manufacturing establishments. The ideas which can serve as a profitable starting point for research work, can frequently be provided by the study of obscure causes of common fires and accidents, and in establishing the relation between these causes and the amount of goods produced.

A comparison of fire curves, production curves, humidity curves, temperature curves and curves showing the prevalence of epidemic diseases and conditions contributing to the health and comfort of the employees, can show these factors to have a direct bearing on the production of goods. The following curves will give you an idea of the relations between fires and humidity in several industries and the practical results which such studies can lead to.

Since attention was first called to the relation between humidity and rubber fires, many humidifying appliances have been installed in rubber factories. Provision is being made for controlling the humidity of cotton picker rooms, and just now apparatus is being installed for preventing fires and decay in large piles of stored pulpwood by keeping it moist with artificial fog.

CHAIRMAN FITZGERALD: At this time I want to appoint a committee to nominate officers for next year. I appoint on this committee Mr. A. L. Rose, Mr. George R. Johnson and Mr. William H. Larkin.

DISCUSSION

The next matter for discussion is "New Stunts to Promote Safety in the Rubber Industry, Including Conducting Safety Work at Minimum Expense." I would like to hear from some of you on that subject.

MR. M. L. COFFEY (Providence Rubber Company, Providence, R. I.): There is one sentence in the program that interested me. I refer to the

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clause "conducting safety work at minimum expense," as applied to the mechanical side. Many times safety devices are objected to because they are too complicated and take a lot of time from the work of the men, and in suggesting safeguards or other devices the safety man, while he should take the initiative should also get suggestions from the engineering department and from the men working on the machines. One point he must bear in mind is to make the device as simple as possible. I think that he will then find his work more productive with the management and with the men also, for they both appreciate a simple device more than a complicated one.

MR. H. T. MARTIN (Fisk Rubber Company, Chicopee Falls, Mass.): I do not know as there is anything new in the way of safety devices. We think we have struck something new and try it out and either discover that it is an old plan and maybe is being used by someone else or else that it has already been proved impractical. During the business depression, we found that the men laid off were, as a general rule, the men who were having accidents. Poor productive records generally went hand in hand with poor accident records. Then with the picking up of business we took on several hundred employees and we immediately found our accident frequency record mounting to the skies. Of course, we are doing all we can in the way of educational propaganda to prevent accidents and are carrying the safety gospel down the line to the men on the job. At least we are doing what we can. We assume a great many times that the man on the job is being reached but we do not know it. We hold our general safety committee meetings and discuss matters of policy, and the foremen hold their monthly meetings in the various departments and we suppose they talk to the men but we do not know it. We have, therefore, adopted a policy which I think has already shown good results. Each foreman is required, before he goes to his departmental safety meeting, to hold a two-minutes' talk with each employee in his room. I do not mean that he goes up and says, "Bill, I want to talk safety to you for a few minutes," but he does it in a tactful way and before he leaves that man he has got suggestions from him relative to his particular job. We have found that some of the most simple suggestions have caused the removal of certain hazards that have existed for years.

CONDUCTING SAFETY WORK AT MINIMUM EXPENSE

MR. BECK: We have in our company three groups of factories and we charge these factories in accordance with their expense. We have found that this causes a spirit of friendly competition. Of course, we were all interested in seeing just which factory was running the highest, and then we bring it down into individual departments. The factories were interested in seeing how their expense was comparing with the other factories, and right there we got our reaction, and that was that the factories were not all reporting all their accidents. That was just the information we wanted. I know of one case where a certain factory's expense was very low but I took the figures on that particular factory and compared them on the basis of percentage of increase since 1914 and I found that in

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that factory their payroll had increased and the percentage of increase was enormous compared with their production. So when the papers went back, they realized that they were not having the splendid record they thought they were, for they had lost sight of the fact that men getting $20 or $30 or $40 a week in 1914 were now getting a great deal more than that. We took the average earnings and compared these with much better results.

The matter of conducting safety work at minimum expense is an important one and is something that will go a great way toward selling safety to the managements of factories and business enterprises generally.

MR. E. R. LAWLER (Hartford Rubber Works Company, Hartford, Conn.): I would like to ask the experience of some of you on the question of allowing warmers and mixers to wear gloves at their work.

MR. MARTIN: Our experience has been that we cannot very well do it. There certainly is no question as to a glove being dangerous. I have a very vivid recollection of finding on my desk one morning, rolled up in a newspaper, a man's hand in a battered glove, where the glove was absolutely the cause of the accident. His hand had got near the gear and the glove had caught and in pulling away he had pulled so hard that he had pulled the tendons of his hand clear from the elbow. At that time an order was posted forbidding the men to wear gloves on any such machines. Within a short time the foreman came around and said that the men were complaining that the stock was too hot to handle. It is all very easy to say, "let them toughen their hands," although that is my belief. I would not let them wear a glove, but I haven't the last word on that by any means. They will put these gloves on; sometimes on one hand and sometimes on two. We have made some study in an attempt to get a glove that could be easily removed. We had one made, a large glove with a clasp on the back, the glove large enough so that if it became caught it could be taken off very easily, but I frankly say that I do not believe you can eliminate the danger so long as gloves are used, on these machines. I would like to see the gloves eliminated, but when a foreman comes to you and says that some workman who is a crackerjack is in danger of badly blistering his hands because they are tender, what will you do?

ADJOURNMENT.

WEDNESDAY MORNING SESSION

CHAIRMAN FITZGERALD: First we will have the report of the nominating committee.

MR. A. L. ROSE (Kelly-Springfield Tire Company, Cumberland, Md.): The committee is pleased to announce the following nominations:

Chairman: Mr. H. T. Martin, The Fisk Rubber Company.

Vice-Chairman: Mr. C. F. Horan, Hood Rubber Company.

Secretary: Mr. E. W. Beck, United States Rubber Company.

(The report was unanimously adopted.)

CHAIRMAN FITZGERALD: I take pleasure in introducing Dr. Weber.

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SAFETY—FROM THE CHEMIST'S STANDPOINT

DR. LOTHAR E. WEBER, BOSTON INDIA RUBBER LABORATORY, BOSTON

The materials that are used in the rubber industry are scarcely such as to classify it as hazardous, but there are a number of materials employed which exert an injurious action on the workmen and, to a certain extent, on the ultimate consumer. The materials that I have in mind can be divided into three groups. There are the compounding materials, certain solvents, and then the notorious organic accelerators.

COMPOUNDING MATERIALS

Considering first the compounding materials, probably the most injurious, or the one most capable of being injurious, is litharge, which, as you know, is an oxide of lead. The use of litharge in the rubber industry is steadily on the decline for the reason that it is very expensive to use on account of its so-called "high volume cost." Litharge is a very heavy material, and most rubber goods being sold on a bulk basis, the cost of the compound is much increased by the use of litharge; but there are still two branches of the industry which use litharge to a large extent. They are the shoe industry and the clothing industry. The number of concerns making rubber shoes and rubber clothing is relatively few and those engaged in it have been in this line of manufacture for many years and are familiar with the dangers of litharge. The main precaution to be observed by the workman who comes into contact with litharge is cleanliness, especially before taking of food. It is most important that the hands and face be carefully cleansed; not necessarily scrubbed, but precautions must be observed to prevent the entrance of litharge into the mouth.

From the standpoint of the consumer, litharge should certainly not be used in the manufacture of articles which are liable to come in contact with the human body. There is a tendency to the use of litharge in baby nipples. A highly poisonous substance like lead compound ought to find no use whatsoever in baby nipples, and while the matter has not been a part of official legislation, it would seem that it should be actively brought to the attention of manufacturers of nipples. During the war, there was considerable work done on the advisability of putting litharge into gas masks compound and, while the point was never definitely settled, the weight of sentiment was against the use of litharge for the masks.

The next material which I would like to call to your attention is a yellow pigment which is used somewhat in the industry. Fortunately, there is very little demand for a yellow compound, but when the yellow color is needed, the rubber technologist is in somewhat of a difficulty, because there are few good yellow pigments of strong and lasting quality. Unfortunately, arsenic sulphide has got an excellent yellow and there is a tendency on the part of certain dealers in rubber supplies to develop a market for arsenic sulphide. I remember once objecting to the use of the material to such a broker and he acknowledged that

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arsenic compounds were poisonous, he acknowledged also that some arsenic sulphides were poisonous, but he took the stand that his particular arsenic was not in the least poisonous. Of course, that is pure nonsense. Arsenic has absolutely no use in rubber manufacture.

There has been some agitation to limit the use of antimony compounds in the manufacture of rubber articles which come into contact with the mouth. Antimony in the form of gold and crimson antimony is relatively insoluble and, in my opinion, can be used with perfect safety. The same applies to brilliant red. Vermilion is practically insoluble.

SOLVENTS

We now come to the consideration of a few of the solvents used in the industry. That which probably has the biggest volume of consumption is gasoline. Gasoline can scarcely be designated as being poisonous or even irritant, although it has the property of producing a condition not altogether dissimilar to alcoholic poisoning. The atmosphere in the spreading room often gets very thick with naptha or gasoline and it is not infrequent to find some of the operators exhibiting a pronounced "jag." The condition is not serious at all. It passes away as quickly as the more common alcoholic "jag." In this connection, it is interesting to note that the consumption of milk—even milk chocolate—has the property of rapidly reviving one who is temporarily afflicted.

A solvent that is used very largely today and has been criticized as very dangerous, very injurious, is benzol, and, personally, I feel that an injustice has really been done this particular substance. Undoubtedly, there are on record cases of very disagreeable and very toxic examples of the action of benzol, but the point that always stays in my mind is that in England benzol, toluol, and xylol, are used almost exclusively in the spreading operation. In this country gasoline is the favorite solvent, but in England solvent naptha is used. Now, if benzol is so very poisonous as to make its action marked when it is used for spreading, why is it not more pronounced when the whole atmosphere which the workmen live in is saturated with benzol and toluol and xylol? I do not want to give the impression that benzol is a fool-proof substance, or that there are not cases on record where benzol has been at fault, but I would strongly like to make the suggestion not to assume that benzol is the cause until other possibilities are exhausted.

Another solvent that is used quite largely in certain branches of the industry is carbon disulphide, a very desirable substance but frightfully explosive. Its action on the workmen is not very pronounced, but carbon disulphide is, I think, without exception, the most explosive substance used in the industry, and it has the further disadvantage, when being converted into carbon dioxide, of creating a very foul smell; and when the carbon disulphide gets on the tires the fumes evolved are most disagreeable and irritable. Water seems to have very little effect, even steam has very little effect, in quenching a carbon disulphide fire. The only thing that is really effective is to smother the flame with sand.

Sulphur chloride is a substance which, while scarcely a solvent of

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rubber, is a liquid and finds considerable application in certain branches of the industry. It has a very disagreeable odor and to people not accustomed to it, it is apt to give rather serious headaches, but after the operator has had a chance to familiarize his constitution with the odors these headache tendencies disappear. It is rather interesting to note that there seems to be quite a connection between the sulphur chloride and its effect on the operator, who shows a marked resistance to colds. Operators in the spreading industry where the article is finally vulcanized, seem to be almost entirely immune to the ordinary form of winter cold.

ORGANIC ACCELERATORS

I don't want to take up the accelerators in detail and label this one safe and that one unsafe, but I would like to call your attention to one or two generalities in the use of organic accelerators. Don't be misled by the persuasion of some salesmen to the effect that because the Jones Rubber Company is using a certain accelerator which has a bad reputation, it is unsafe for you to use it. I have in mind especially paraphenylenediamin, a very desirable accelerator from the standpoint of the properties it imparts. It reduces the length of the vulcanizing process certainly one half. Further, paraphenylenediamin imparts very desirable properties to the vulcanized product. It is frightfully poisonous. I know it has been used, and used successfully from the standpoint of safety, but the success depends upon the way it is used, and that is not generally the right way. Paraphenylenediamin, to my mind, has absolutely no use in rubber manufacture. There have been efforts to exploit it and they have always relied upon the fact that certain large companies are using it, but the fact that they are able to use it lies purely in the way they have been able to safeguard it.

The other point I want to make is on the positive side; that is the fact that because a concern in the middle west has been unable to continue the use of a certain accelerator, due to its poisonous action, there is still a possibility of some other concern being able to use it. It would seem that in the case of certain accelerators the atmospheric conditions have a marked effect on their toxic properties. I have in mind particularly, hexamethylenetetramin. Hexa is used in the industry in very large amounts and is used with reasonable safety. I suppose every one who uses hexamethylenetetramin has had some trouble, but with ordinary precautions it is used daily in enormous quantities. Yet there are certain concerns that simply cannot use a pound of it. Not only do they have trouble in the building room but even the shippers are covered with the hexa rash. On the other hand, a concern a few miles away may be using it with perfect safety. So the two points I would like to make about accelerators are: don't rely on salesmen's persuasions regarding a product which you know to be unsafe, and, furthermore, don't believe that a product cannot be used because it may have a bad reputation. Undoubtedly, the development and utilization of organic accelerators has been the greatest technical advance in the last twenty years—since the discovery of localization. I think everything ought to be done to foster

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and develop the use of accelerators. Such development should certainly be carried out with safety.

DISCUSSION

MR. C. F. HORAN (Hood Rubber Company, Watertown): I should like to ask Dr. Weber on what basis he compares the solvent naptha that is used in England with the use of benzol in this country; whether he believes that solvent naptha and benzol are the same thing?

DR. WEBER: I think I referred to benzol, toluol and xylol, and solvent naptha is essentially commercial xylol. Without going into the chemistry involved, benzol, toluol and xylol are very closely related. If benzol has these exceedingly toxic properties, one would expect them to be apparent in toluol and xylol, and, in that case, they ought to be apparent in solvent naptha. I am perfectly willing to grant that, in view of the higher boiling point of solvent naptha, these toxic properties might be observable to a lesser extent, but I ask you to take into consideration the different conditions under which the two materials are used. Benzol is used as a solvent in the cementing process and toluol is used in the spreading industry. It is seldom that there is an appreciable amount of vaporized benzol. The concentrations of benzol in a building room, and the solvent naptha in a spreading room bear no relation to each other at all. It is for that reason that I cannot see why such weight should be laid upon the poisonous action of the benzol.

MR. S. M. SCHOTT (Morgan and Wright Division, United States Rubber Company, Detroit): We all know of the pigment and solvent situation and how they act, but there has been comparatively little study, so far on the physiological effect on women in the rubber industry. Have you had any experience along that line?

DR. WEBER: You mean the difference in the effect upon men and women? I think that it has been proved that in the case of solvents, women are much more susceptible.

MR. SCHOTT: I meant the organic accelerators and whether women should be excluded.

DR. WEBER: As a matter of fact, the industry that uses the accelerators to the largest extent is the tire industry. They employ relatively few women.

MR. COFFEY: I would like to ask what effect lamp black would have and also what effect flake aluminum would have in the materials that go into compounds?

DR. WEBER: Lamp black and gas black I do not think have any physiological effect. I think they have a decidedly physical effect; the inhalation of large quantities of finely divided materials is very undesirable for the lungs. Physiologically, I think that gas black is rather a good thing to take in because it is supposed to be rather a good remedy for indigestion. I do not know whether one would like to eat gas black in a case of dyspepsia, but I think our old friends from Poughkeepsie use gas black or charcoal, or something, in their famous coughdrop. I should not think aluminum flake is dangerous. It is a relatively insoluble substance. It is not much more than clay.

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HAZARDS OF ANILINE OIL

MR. BECK: Would you please enlighten us as to aniline oils?

DR. WEBER: Aniline oil is, of course, an arch offender and, to my mind, it has no place in the industry whatsoever. Aniline oil ought not to be used. I will acknowledge it is a very desirable accelerator. It is not awfully powerful, as certain accelerators go, but, from the standpoint of the mixing room, let us say, of the man in charge of compounds, aniline oil is very desirable. From the standpoint of the operators it is an outrage. With sufficient draughts it may be claimed that it can be used with safety, but the susceptibility of the workmen varies. Some people just take a smell and turn blue. Other people can take a foot bath with impunity. To my mind, it ought not to be used, and I think it is to the best interests of the industry not to use it.

MR. LAWLER: I would like to ask Dr. Weber what he would recommend as an antidote for a person overcome by aniline.

DR. WEBER: I think I would answer that question negatively. I don't think that an operator ought to be allowed to get into the condition where he would be overcome. Aniline poisoning does not spring on one suddenly; it is a slow process, and, if the operator has been actually overcome, the poisoning has advanced to a protracted state and I think it is time for the physician. I feel rather strongly on aniline oil: I feel very strongly against it. Your question, to my mind, presupposes that one should allow the operator to get into the condition where he is overcome. I do not think that you ought to let the matter get to that stage. When a man is actually overcome with aniline oil, I think that is a very serious condition.

MR. HORAN: Can you give us any information in regard to thiocarbanalide, whether it carries with it any of the dangers as an accelerator that aniline does?

DR. WEBER: The product marketed as thiocarbanalide and the other products marketed under a variety of trade names, are apt to contain appreciable quantities of free aniline oil, and in cases the thio has been found to give the same symptoms as aniline. That is due to the impurity of the thio. Thiocarbanalide is one of the safest accelerators in use. Its great disadvantage is a technical one; it is likely to scorch the stock.

MR. HORAN: I want to ask Dr. Weber, if he should find that guinea-pigs and rabbits exposed to 23/1000 of a cubic centimeter of benzol were, in a set of six experiments, killed within twenty minutes, and then should find that guinea-pigs and rabbits exposed to twice as much toluol, xylol or solvent naptha were not killed within an hour, whether it would not change his mind as regards the relationship of benzol and solvent naptha?

DR. WEBER: I still do not think that just on the basis of a few guinea-pig experiments I would altogether change my feeling on that point. Mind you, I am not arguing on the point of a safe benzol, but I do think it is misleading to brand benzol as so highly poisonous, for the reason that when some poisoning occurs in the factory, everybody says, "Oh, that is the benzol," and lets it go at that. If you get some poisoning in

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the factory and are using benzol, and you are sure nothing else is at fault, then you are entirely justified in attributing it to the benzol.

CHAIRMAN FITZGERALD: We have with us Mr. Jameson who has had a lot of experience in keeping factories clean.

KEEPING A RUBBER FACTORY CLEAN

WILLIAM JAMESON, ADVISORY ENGINEER, THE FISK RUBBER COMPANY, CHICOPEE FALLS, MASS.

In the rubber industry, because of the nature of the work, it is necessary that more time and thought be given to the subject of factory cleaning than in many other lines of manufacture—because of the quantities of grease, oil and dust to contend with. In some plants even now the cleaning is done under the supervision of the foremen in the various departments. This is the least important thing the foreman has to do. First comes production, naturally. The sweeper is usually a man who has been in the employ of the company for many years and because of disability is unfit for other work. He is handed a broom with no instructions whatever and placed at work. Frequently he is taken off this work and placed at other work, such as running errands or filling in a niche caused by the absence of some productive employee. No accurate idea can be obtained in such a plant as to the actual cost of sweeping and the results obtained under such a plan can be only partially efficient. Other plants, which realize the importance of maintaining cleanliness, have organized departments to specialize in this line of work.

ORGANIZATION OF A SANITARY DEPARTMENT

In one plant with which I am familiar, a sanitary department was organized about two years ago under the supervision of a man who had no other duties than to keep the plant clean. A considerable amount of discussion and many conferences were held before any attempt was made to get under way. A few of the sweepers who were then under the supervision of production foremen were taken over; a week or so later another group was transferred to the sanitary department, and so on, until the entire group of sweepers had been transferred. Several changes were made in personnel, weeding out driftwood and replacing with men who were able to perform a day's work.

The men who were to be used as sweepers were distributed about the plant to the best advantage on both day and night shifts with proper supervision, proper equipment, and headquarters where additional equipment and material could be secured when needed.

Crews were organized to clean toilets, lockers, sinks, stair towers, tunnels, overhead passageways, mill pits, elevator pits, windows and factory offices, and another group was organized for general utility work.

Immediately better results were obtained at a considerable reduction in cost. Some difficulty was encountered at first in defining the duties of the sanitary department as its men had been called upon to carry on so many different activities under the old plan. In some cases it was

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necessary for the foremen to hire a helper to do the work the sweeper had been doing.

One superintendent exercises general supervision over the entire department assisted by two foremen—one for days and one for nights.

Three squad leaders of recognized ability—two on the day force and one on nights, perform emergency work and work with and check men when in squads or on special work.

During the day, in departments or locations where litter accumulates in great quantities, one or more sweepers are assigned and put in all their time in one locality. For the most part the sweeping is done by placing men in two squads, each squad looking after certain sections of buildings, covering all sections at least once daily.

The night sweepers work in one squad and usually start at the top floors and work to the basement, returning in the early morning to clean those places where the plant has been operated during the night.

The entire day force and many of the night force work Saturday afternoons and make a general weekly cleaning, as most of the machinery is idle and the men can get into spaces which they are unable to reach during the week.

With a few exceptions for emergencies the men of day force report one hour later and quit one hour later than the factory working force. The night force report and quit one half hour later than the factory night force.

Toilet cleaners both day and night make the rounds of the factory with a few exceptions, twice in twenty-four hours, supply racks with paper, flush, cleanse and disinfect each bowl and urinal in some sixty-four toilet rooms.

Two men on day force scrub and clean sinks, drinking fountains and shower baths, replenish containers with liquid soap, etc. This is not done at night unless deemed necessary. Weather permitting, three men are used to clean windows. Three women wipe, dust and disinfect 6,000 metal clothes lockers, making the rounds of the factory about once in three weeks. Two women scrub and clean women's toilets, dressing rooms, restaurant, hospital and stair towers. One man on nights scrubs the offices of the factory foremen. One man on nights cleans lamps and shades. Two men gather up and replace 1,500 paper cuspidors, partly filled with sand, containing a small amount of chlorinated lime. During the day such cuspidors as need attention are replaced by the sweepers in their particular sections. The soiled cuspidors are removed to a dump rather than sent to the incinerator as the sand in them smothers the fire. It may be interesting to know that the paper cuspidors are more economical than crockery, and their use does away with washing or rinsing. A yearly saving of approximately $1,100 has been effected by the use of paper cuspidors.

The factory office building with its polished floors, desks, brasswork and cabinets, tiled washrooms and toilets, is cleaned by a specially trained force both day and night. One man handles towels for factory offices and shop, delivering and collecting daily in the offices and twice a week in the shop. Employees in offices are furnished with small face

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towels free of charge. Employees in the shop may purchase a towel at cost and as long thereafter as they remain in the employ of the company they may receive twice a week a clean towel in exchange for a soiled one. The towel man also cleans and disinfects each week all factory telephones, cleans bulletin boards, and cleans safety mirrors which hang in dangerous passageways. A general helper is employed to keep an accurate account of all supplies received and given out by the department, assist the towel man, mix liquid soap and disinfectant solutions, spray insect destroyers, etc.

Metal cans about the size of a barrel marked with the word "Rubbish" together with the numbers of building and floor where located are placed throughout the factory for sweepers to deposit sweepings in, and are used by all employees for rubbish. In some instances special cans are provided for oily waste. These cans are then emptied into large iron rocker dump bodies on wheels, capacity of 9 cubic feet, which are removed twice in twenty-four hours, or more often if necessary, by means of elevators and electric trucks. This rubbish is sent to an incinerator.

STATE LAWS ON SANITATION

In addition to maintaining plant sanitation, the sanitary department is also held responsible for provision of adequate toilet and washing facilities, in compliance with state rules and regulations. Moving of departments from one location to another, the changing from male to female help, etc., requires considerable vigilance to keep within the law.

VENTILATION OF MILLS

The Massachusetts laws on the removal or elimination of dust are not very severe, and most employers without any criticism from a factory inspector, have provided more suction hoods and ventilating systems than the law requires.

In England the laws are very strict and require that the air must not contain above a certain percentage of dust. An installation of a ventilating system in a mill room in England, must, upon completion, pass the requirements of the board of health, and the British rubber manufacturers have given a great deal of thought to the subject of ventilation. The ventilation of their mills is obtained by the use of a Keith-Blackman 15-inch pressure fan, running at 1120 r.p.m. The volume of air displaced by this fan is approximately 4000 cubic feet per minute. The size of the opening at the back of the mill is 48 inches long and 1 inch deep. Such a fan supplies three 48-inch mills.

CLEANING OF MILL ROOM

It is generally conceded by those familiar with rubber factories that one of the hardest problems to contend with in connection with cleaning, is the mill room. In one rubber factory in this country several exhaustive studies have been made in connection with the cleaning and ventilating of mill rooms. These studies may be briefly summarized as follows:

It was found that soapstone rises to the ceiling and is held in suspen-

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sion while more stable compounds rise about 8 feet and then settle. To ascertain the amount of soapstone and other compounds in the air, small sheets of cardboard were placed to determine the plane of greatest deposits at levels as follows:

Floor—5 ft. (workmen's breathing plane)—9 ft.—12 ft.—18 ft.

The result of twenty-four hour periods showed that the main heavily loaded strata lies from 10 ft. down to the floor. The material (under microscope) proved to be a mixture of carbon black, zinc oxide and sulphur.

A study was then started of the air currents both in the room and in the suction system used for conveying the dust from the mills. This test was made with an anomometer. No strong air currents appeared at any point in the free air of the room. The main tests were at the peak and edge of each hood over the mills. Maximum velocity at the peak was found to be 1450 ft. per minute with such a dissipation of suction that at the edge of the hoods the velocity was reduced to 275 ft. This, proved by observation and tests, is not sufficient to draw the dust and waste matter which rises at the edge of the hood.

Great variation was found in velocity at different outlets and proof was secured that the system was not working 100 per cent. At one hood no current of air was found. As a result of this investigation the capacity of the fan was increased and better results were obtained.

I believe it is not necessary for me to go into further details of the ventilating system as this subject was fully described at the last Safety Congress. Conditions were also improved materially by closer supervision of the mill operators.

The following remedies were applied with good results:

1. At mixing mills—racks of trays were provided, onto which mixed rubber from the mills is placed without dusting with soapstone.

2. Stock storage rooms—most of the dust can be eliminated by spraying the stock with wet soapstone.

3. At calender warming mills—all stock is kept on platforms off the floor. When excess stock is batched out and moved from the calender, same is put on trucks, using liners between sheets, which eliminates the use of soapstone from the calender room.

4. Spilled compounds—all batching compounds are delivered on trucks to the mills, six to eight pans per truck. These compounds are kept on the trucks until the rubber is broken down. Batch pans are set on the edge of the mill pan and minerals are shoveled onto the mills, one small scoop at a time. Before dumping the batch pan on the mill roll it should be nearly empty. Empty pans are placed back on the truck. No pans should be thrown on the floor.

5. Dust from mixing mills—emptying pans as mentioned in item No. 4, will keep down the dust to a remarkable extent. Most mills are hooded, and the type of hood found to be most effective has the following features:

It is very low.

Height of hood from mill proper is 12 inches.

Entire back of mill is closed in by sheet metal. Old style hoods are

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made more effective by attaching a canvas curtain to the back of the mill and keeping the curtain down at all times.

DISPOSITION OF MATERIAL COLLECTED BY SWEEPERS

Dirt and dust can be controlled to a great extent by marking the different spaces around calenders for stock trucks, liners and shells. Keep all stock for warming mills on platforms off floor. Waste cans for paper, strings and torn or used tags are provided at each calender.

Some of the material gathered up by the sweepers—is disposed of as follows:

1. *Rubber and fabric.* Removed from rubbish and placed in special containers which are emptied and contents cared for by the scrap clearance department.

2. *Calender and mill pits.* Cleaned when machines are idle, at present by hand, using pails and barrels. Oil and grease are transferred to a specially constructed, movable, metal tank (250 gal.) and are re-used for lubricating purposes where an inferior grade of oil will serve. The rubber in the pits is sent to the washroom to be reclaimed. The residue in the pits is placed in heavily constructed barrels and carried to a dumping ground.

3. *Tube room.* Tube transfers and worn out cloth wraps are placed in rubbish and burned at incinerator. Soapstone deposit in the bobbin machines is removed by the department and sent to dump.

4. *Mill, motor, and heater bases.* Grease is mixed with dry sawdust and removed with hoes, shovels, scrapers and stiff brooms. Where the oil runs down the side of the mill bases a bank of sand is made to prevent the oil from spreading about the floor.

5. *Elevators.* Pits not provided with drains are equipped with ejectors by which surplus water is removed, the residue is then mixed with dry sawdust and removed to a dump. Pits with drains are flushed with steam or water as often as necessary. Elevator shaftways are cleaned as often as condition requires, usually on a holiday or when the plant is shut down. This is usually a long, tedious job, especially if the shaftway is not entirely enclosed, for as dust is loosened it flies about and settles in all spaces adjacent to the shaftway which means that they, too, must be cleaned after the elevator is finished. An elevator operator is furnished and the cleaners, some with long handled brushes, some with cloths, ride on top of the elevator cage. All men are furnished with goggles and respirators.

6. *Tunnels and drains.* In the absence of an ejector, the surplus water is bailed and the residue is then mixed with dry sawdust and removed to a dump. In some large drains, screens are present which are cleaned by means of a steam hose. After cleaning, all pits and drains are disinfected.

7. *Conveyors.* Small conveyors are usually cleaned by hand by means of small bench brushes with dustpan. Large conveyors, when attachments can be made, are blown out with compressed air and the dirt is swept up later. This can be done only when the plant is shut down.

8. *Large quantities of paper or wood.* Usually handled as salvage and

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taken care of by the foremen in the department being sent to salvage department for disposal. (Paper bags used for carbon black in the mill room are considered worthless and are bundled by sweepers and sent to incinerator.)

9. *Metal chips.* These are placed in special metal containers by sweepers, and foremen in department where they originate have them delivered to the salvage department.

10. *Water in basements.* When necessary to move it quickly this water is pushed into elevator pits by means of stiff brooms.

11. *Cleaning machines.* These are taken care of by employees in their own departments under direction of their own foreman.

12. *Box shop.* The litter here is either wood, shavings, or sawdust and is handled in this department. Here the machinery is of such a dangerous nature it is deemed best to keep out all men not familiar with it.

13. *Oily waste and other fire hazards.* These accumulate when men from maintenance departments work Sundays or holidays. Rubbish cans are placed in yard at several entrances to buildings and men having material of this kind place it in cans when their work is finished. Cans are emptied by yard men.

TYPE OF HELP BEST SUITED FOR A SANITARY DEPARTMENT

Experience has shown that young men are not contented with this kind of work, and men well advanced in life are not adapted to the work. To build up an efficient sanitary department every effort should be made to secure middle aged men who are physically fit to remain on their feet a considerable portion of the day, doing a great amount of stair and ladder climbing, hauling cans of rubbish, etc. Such a force at work in a plant, with intelligent supervision, will maintain sanitary conditions, reduce cost of sweeping, increase plant efficiency and morale, and reduce accidents.

I may say that I got some figures before I left the shop to show what this accomplished in dollars and cents. In the month of August, 1920, the cost for cleaning per 10,000 square feet of floor space was $10. For the same month in 1921, with production about the same, a reduction in cost was made to about $4.00.

CHAIRMAN FITZGERALD: The next paper is by Dr. Quinby.

PRACTICAL PLANS FOR MEDICAL SUPERVISION IN RUBBER PLANTS

DR. ROBERT S. QUINBY, SERVICE MANAGER, HOOD RUBBER COMPANY, WATERTOWN, MASS.

It is a pleasure to preface these remarks with the statement that the rubber industry occupies a position well to the forefront in the progress of industrial medicine. A recent report of the National Industrial Conference Board indicates that the per capita amount spent on medical supervision in the rubber industry is well above the average of all indus-

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tries. In the nine rubber manufacturing plants included in this investigation, the average yearly per capita amount spent was $5.41, as against an average of $4.43 in the other industries reported. I have been in personal contact with a great many of the industrial physicians in the rubber industry and know that they are doing a type of medical work which demands high recognition.

In considering plans for medical supervision, we may do so under the following three headings:

I. Physical equipment.
II. Personnel.
III. Functions.

Conditions in different plants are so variable that it is needless to attempt to definitely suggest the physical equipment, but I would like to point out several important features in this connection. It is of primary importance that the plant dispensary be so located as to be easily and quickly accessible to all parts of the factory. In a relatively small plant, one dispensary centrally located is sufficient, whereas in large plants it has been found desirable to have several branch dispensaries so located as to be easily accessible to all workers. Frequently a person will neglect or delay treatment because of the inconvenience or loss of time necessary to go to the hospital, and the most obvious way to eliminate this condition is to so locate the dispensary that it will be convenient to all the workers.

DISPENSARY SHOULD NOT BE TOO ELABORATE

A frequent mistake is made by having a dispensary too elaborate. A workman often feels hesitant and uncomfortable to visit a medical department which gives an appearance of being "highbrow." Cleanliness and all requisites of good medical work may be obtained without any extra frills, and I would warn against needless expense and frequently bad effects of unnecessary equipment. We are apt to fall into the same error in connection with drugs and surgical instruments. Relatively few standard drugs and instruments are necessary. This economy will meet with the approval of the management as well as patients who are treated.

The personnel of an industrial medical department will vary again with conditions. In the beginning, a nurse and a doctor on call were in most cases all the staff considered necessary, but with the development of industrial medicine the desirability of full-time medical supervision as well as nursing service has become recognized. I believe that a plant employing 500 or more people justifies one full-time physician. The ratio of doctors to employees in larger plants should probably be an additional physician to each 1,500 workmen. The number of nurses required will vary with the functions attempted in different medical departments. If nurses are used to visit absentees as well as take care of hospital routine, it will be necessary to have more, but I believe that ordinarily one nurse to each thousand employees is a fair ratio.

"CHEAP" DOCTORS OR NURSES NOT FITTED

Before leaving the subject of medical personnel, I would like to emphasize the fact that a "cheap" doctor or a "cheap" nurse is a very poor in-

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vestment. A doctor and nurse who have been successful in private practice, everything else being equal, will be successful in industrial practice, and while we are able to deal more directly and perhaps exert more authority in a factory than we can in private practice, we should be extremely careful not to exercise needless authority, and should remember that the success of industrial work requires as much courtesy, care, and skill as does private practice.

The question of delegating first-aid treatments to foremen or workmen instructed in the rudiments of such work will depend upon conditions, but in general it is not desirable. A competent physician or trained nurse with years of experience is all too likely to have poor results without increasing this likelihood by intentionally placing the work in the hands of those comparatively unskilled. In the long run such procedure will prove to be false economy.

SUGGESTED PROGRAM FOR HEALTH SUPERVISION

An adequate program of health supervision should assume the following functions:

I. Physical examination and necessary re-examination of applicants and those already employed.

II. Dispensary treatment of sicknesses, accidental injuries, and in many cases dental, ocular, and other conditions.

III. Supervision of factory sanitation and elimination of disease hazards.

IV. Home nursing and medical supervision of such cases as may seem advisable.

V. Education in matters of health and personal hygiene.

Physical examination forms the foundation of any well-developed program of health supervision; it is the inventory of health conditions; it is the basis of a preventative and constructive industrial health program. Until a very few years ago physical examination of workers was looked upon by the majority of industrial managers as a questionable undertaking, but at the present time, at least in most of the larger industrial plants, it is a well-recognized part of both employment procedure and medical supervision.

Consider for a moment the physical defects we may expect to find in any given group of individuals applying for work. Our experience has shown the following approximate percentages of some of the more important defects:

Grossly defective dental conditions	40%
Grossly defective eye conditions	8%
Grossly defective lung conditions	4%
Grossly defective heart conditions	3%
Herniae	5%

These percentages will vary somewhat from the experience of others because of the variation in methods of classification, but certainly such an array of physical defects among an average group of individuals emphasizes the importance of these conditions in the consideration of employment and the placement of workers.

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DEFECTIVE EMPLOYEES MUST BE CAREFULLY PLACED

The great majority of these defective workers may be satisfactorily employed because of the diversity of operations in the ordinary plant, but it is of vital importance both for the protection of the individual and his employer that such defectives be placed in occupations for which they are best qualified, and can contribute most to production.

The examination of drafted men indicated that about one-third were sufficiently defective to cause their rejection from the army. In industry it has been the experience that it is not necessary to reject any such high percentage of applicants, and such rejections should be only for the following reasons:

I. That employment would be a menace to the individual.
II. That employment would be a menace to fellow-workers.
III. That employment would be a menace to property.

As an instance of the first condition, we might cite an individual with advanced organic heart disease; of the second, an individual with active tuberculosis; and of the third, an individual mentally unbalanced. In general, we find in the vicinity of 15 or 20 per cent who require, because of physical conditions, selected employment under more or less frequent medical supervision.

Physical examination should, and, if properly done, will bring about a more intelligent placement of applicants for work, the discovery and subsequent correction of many physical conditions which would be prone to become more serious and affect the productivity of the individual, the elimination of persons who because of physical defects are unfit for employment, the transferring of certain persons already engaged to occupations for which they are better adapted physically, and lastly, the closer acquaintanceship between the worker and the physician and therefore opportunity for advice and instructions in matters of health.

TREATMENT OF HEALTH DEFECTS

The second function of an industrial medical department, which is ordinarily considered as the first, has to do with the treatment of different abnormal conditions. Industrial dispensaries were primarily established for the purpose of treating wounds resulting from industrial accidents, but it very quickly became apparent that disability due to sickness was as important as that due to accident, and for that reason we should provide facilities for taking care of disease as well as injury.

The factory dispensary should provide insofar as possible for the remedying of defects found as a result of physical examination; it should provide for treatment and giving of necessary advice to such workers as are taken sick during work, and should provide for the earliest possible treatment of accidental injuries.

Without detracting from the great credit due to the work of safety departments, it is fair to say that much of the accident disability reduction has come about through the early treatment of trivial wounds. Infections are ordinarily the cause of a high percentage of accident disability, and the safety director working with the foreman to bring the injured man

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immediately to the dispensary for treatment has eliminated thereby a large amount of lost time from infections. The earliest possible treatment of wounds is the most important feature of this type of work.

GOOD TEETH AN IMPORTANT FACTOR IN HEALTH

As has been indicated, dental defects are very frequent among workmen and are the cause of much discomfort and loss of time. The effects on general health of such conditions are being brought to our attention more clearly, and it has been found practical in many factories to install dental service in connection with the dispensary work. The same is to a considerable degree true of eye defects, nd at slight cost to the company both these services may be maintained and furnish such service to the workman at a very nominal cost and a minimum amount of time lost from work.

Generally speaking, the factory dispensary should provide for the treatment of as many different types of cases as facilities will allow, and in such cases as it seems impractical to furnish treatment in the factory dispensary the clinic should serve at least as a clearing house and advise such individuals as to where and how they may receive the best treatment. In other words, if it is not practical to provide actual treatment in all cases, it should be the function of the medical department to supervise and follow up all such cases and see that the desired result is obtained.

SUPERVISION OF PLANT SANITATION

The third function of the medical department has to do with the supervision of factory sanitation and elimination of disease hazards. Much of this work may come within the jurisdiction of either a safety director or an engineer, but the direct effect of working conditions on the health of the employees demands that much consideration be given to this question by the industrial physician. We are coming more and more to realize the importance of ventlilation, light, heat, toilet facilities, etc., and it is necessary that these subjects be given due consideration as a part of the health program.

ELIMINATION OF OCCUPATIONAL DISEASE HAZARDS

The elimination of occupational disease hazards should be even more within the realm of the industrial physician's work. He should be the person best acquainted with such conditions and should have the knowledge of how either to eliminate entirely or at least minimize such hazards. The rubber industry offers several chemical hazards, notably lead, benzol, aniline, and urotropin. As has been demonstrated in many cases, it is possible to either eliminate entirely or at least to reduce the harmful effects of these chemicals to a negligible hazard. The accomplishment of this end requires the knowledge of the sources of danger, proper mechanical safeguarding, frequent physical examination of individuals exposed, transferring of susceptible individuals to other occupations, and the intelligent medical treatment in such cases as require it. It may be of interest to state that during the last four years no compensatable disability due to occupational disease has occurred in our factory.

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Even when we have created a satisfactory health program for the workers within the factory, we must still realize that these people spend hardly more than a quarter of their time in the factory, and that, if we are to create the greatest possible constructive influence on health, we must seek to improve home and community conditions, in some cases co-operating with other agencies, and in others working directly.

IMPROVING HEALTH CONDITIONS IN WORKERS' HOMES

Probably one of the most direct methods of improving health standards in the home and of minimizing lost time on account of sickness and injury is visiting such cases by means of nurses, and when necessary supplementing their visits by the services of a physician. Ordinarily about one-third of industrial absenteeism is due to sickness or injury, the other two-thirds to personal reasons. A nurse is usually more competent to investigate absences, because she is familiar with and able to deal with the cases of sickness and injury, and should, if properly trained, be equally competent to deal with such cases as are absent for personal reasons. Then, too, a nurse's visit is less apt to be resented and considered as "policing" than is a visit by an ordinary investigator. A competent nurse, properly acquainted with the factory and the workers, discovers many conditions important from both an employment and a health standpoint, and forms a relationship between the home and factory which is of inestimable value. She is in a position frequently to give helpful service and advice relative to the improvement of health conditions, and will, if the work is competently done, materially reduce absenteeism from all causes.

INSTRUCTION OF WORKERS IN HEALTH MATTERS

Throughout the whole program as it has been outlined, constant attention should be given to the matter of education in health and personal hygiene, concerning which the average individual knows little. Much more can be accomplished by individual than by group instruction in such matters, although the constant individual effort of the doctors and nurses may well be supplemented by different types of articles and printed information relative to matters of health.

RESULTS OF HEALTH CAMPAIGN

In the Hood Rubber Company we have succeeded in reducing lost working time as our medical and allied activities have become more comprehensive and better co-ordinated. Our experience in medical work has covered a period of over ten years. We have probably the oldest factory dental clinic, as well as one of the first ocular and X-Ray clinics. A number of years ago we recognized the importance of physical examination, and shortly after instituted home visiting of absentees by nurses, later supplemented by medical supervision of those disabled by disease or injury. The benefit plan, providing for sickness, non-industrial accident, and death benefits, has been effective since January 1, 1919, while we have conducted our own compensation insurance company since August 1, 1920.

During the last twelve months, in spite of the fact that 35 per cent of

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our workers are women (and the female absence rate exceeds by 80 per cent that of males), our average amount of working time lost has been only 3.9 per cent. Two per cent of this was due to personal reasons, 1.7 per cent to sickness, 0.13 per cent to industrial accidents, and 0.08 per cent to non-industrial accidents.

Translated into working days lost, this means that our factory workers averaged a loss of 11.76 days from all causes, of which six days was due to personal reasons, 5.13 days to sickness, 0.39 days to industrial accidents, and 0.24 days to non-industrial accidents. Compared with other morbidity statistics, which indicate a loss of anywhere from seven to twelve days on account of sickness alone, our record of 5.13 days is very favorable. It would seem, too, that our industrial accident disability rate of .39 days would represent a minimum.

INDUSTRIAL PHYSICIAN SHOULD AIM AT PREVENTION MORE THAN CURE

In industrial medicine, as nowhere else, we have the opportunity of preventing or at least minimizing disability due to sickness or injury, and we should always keep this preventive element of the program foremost in our minds. It is not well to attempt "to make history too fast," particularly when dealing with the human element, and this is especially true in industrial medicine. From a modest beginning, by constant effort and the giving of good service, credit with your workers, your management, and the communty at large will gradually be developed, and in proportion to the development of this credit, definite, useful, results will be accomplished.

DISCUSSION

MR. ROSE: Dr. Quinby would not advise the creation of the branch dispensaries without trained attendants?

DR. QUINBY: That is correct; at least have a trained nurse.

MR. ROSE: Would you get the same service in the branches that you do in the dispensary?

DR. QUINBY: I should say one nurse covering two branches; giving half a day to each. This would be preferable to an untrained attendant the whole day. That is, the nurse will not necessarily treat all those cases, but will take care of such as she is capable of doing and direct the others to the main dispensary where the physician is in charge. That plan can be worked out in detail to suit conditions, and may be very flexible.

MR. ROSE: Then you would not advise the use of a branch unless there is a trained attendant?

DR. QUINBY: I would not.

MR. SCHOTT: I would like to speak of the co-operation the factory doctor can give to the safety man. As a rule, the factory doctor is almost entirely ignorant of factory operation, except that he goes through the plant once or twice a year.

DR. QUINBY: The answer to that is to educate the doctor. The official in charge should arrange for proper co-ordination of the different branches of those activities. It happens in a great many plants that the safety man in some cases, the employment manager in others, a doctor in some others,

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heads up the entire activities, and the amount of co-operation or co-ordination between your different activities will, to a degree, depend on the relative importance in his mind of those different activities. I think it is easy, if you have a full-time physician, to co-ordinate his work with that of the safety manager's work.

There is one other thing I want to speak of, and that is to take a little out of our friend, Dr. Weber. It was my unfortunate experience to sit in at the death of four individuals, presumably caused by benzol, at a time when there was practically no medical literature on the subject of benzol available. In this country there had been reported, through Johns Hopkins, the death of several girls in connection with the cementing of cans, where benzol was the solvent. There was some German literature and, I believe, some English literature in that connection. I suppose we were the last people in the world who were willing to admit that the cause of the deaths was benzol. We brought in such men as Edsoll, Leary (Medical Examiner of Suffolk County), Harvard Medical School's chemical faculty, and anyone else we could think of, to say nothing of the whole staff of one of the large hospitals. Eventually we were forced to admit that the deaths were probably due to benzol.

There have been, as I say, in this country, numerous fatalities due to benzol. I talked with Dr. Flagg, who is in charge of the hospitals of Great Britain, and he attributed the difficulties to ventilation. I think to a degree he was right, but the clinical picture, Dr. Weber, is a very different one from any other. I think we have got to admit certain of these cases. I think we must consider it a serious chemical hazard in the rubber industry. We have stopped using it.

Dr. Weber: As I said an hour ago, I am prepared to argue on either side. The point which I wish to make is that there has been a tendency to regard benzol as being of a highly poisonous nature on the part of the factories that have not a highly developed industrial medical staff. There are certain materials used in the industry which are very poisonous. Some manufacturers do not like to acknowledge that they use these poisonous materials; others do not know they are poisonous. When there is a fatality, they are inclined to ascribe it to benzol, and it is that point that I particularly wished to draw attention to. Perhaps, I fell over the other side and gave you the impression that I think benzol is safe material. I do not want to argue that way, but I do want to argue that it is foolish, it is unwise, to bury your head in the sand and ascribe the fatality to benzol unless you have definitely assured yourself that nothing else can be at fault.

Mr. Schott: There is one point I think might be of interest to us. At the Engineering Section meeting yesterday there was a discussion on the handling of volatile solvents by Dr. Lewis, of the Massachusetts Institute of Technology, and he made the point that he thought it highly desirable, in a mixing mill using benzol or other volatile solvents which might be injurious, that instead of the draught being up above the mill, the draught be at the back of the mill, or down. But as a rule, when you have the draught down, it is difficult to design a proper mixing mill which will work 100 per cent at all times, due to the fact that the compound might

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drop through. However, I think it might be well to carry the thought home to us that there is a possibility of developing a method of ventilation for the mixing mill down towards the bottom, and you will have the fresh air coming in and going past the operator's head and working away from him toward the back, with the ventilator carrying the fumes away.

DR. QUINBY: That was Dr. Flagg's entire contention: that we were foolish to try and lift a substance heavier than air, and that we should ventilate downward; that by that method and an dequate amount of air circulation they would be able to eliminate a certain amount of the danger.

I know of another factory which found that on a medical survey tney had forty or fifty cases of benzol poisoning in various stages, some of which had already died, and they closed up that branch of their work.

DR. WEBER: I would be perfectly willing to admit that the benzol might be a contributing factor; that the organic accelerator might be the prime cause, but benzol alone will not bring about such results. The point I particularly wish to make is this: that there is a tendency in the industry to regard benzol as a very serious offender, and I do not think that benzol alone deserves that reputation.

ADJOURNMENT.

FRIDAY MORNING SESSION

CHAIRMAN FITZGERALD: The first report is from the engineering committee. I received a telegram from Mr. Mitchella, the chairman, saying that he was sick and in the hospital, and that Mr. E. A. Hoener of the Firestone Tire and Rubber Company, Akron, Ohio, has the report.

SAFE HANDLING OF VOLATILE LIQUIDS IN RUBBER FACTORIES

REPORT OF ENGINEERING COMMITTEE, RUBBER SECTION, N. S. C., C. B. MITCHELLA, B. F. GOODRICH COMPANY, AKRON, OHIO, CHAIRMAN.

The principal volatile liquids used in rubber factories are gasoline and benzol. These are considered in various rules and regulations on flammable liquids as being in class No. 1, which covers liquids of lowest flash point. The discussion will be confined to the handling and uses of gasoline and benzol. The usual handling and uses of these two liquids are as follows: Receipt in tank cars or small containers; storage; distribution through factory; cement mixers; spreading and cement dipping; washing and cleaning stock in process of manufacture.

The discussion on handling these solvents will be brief, because it is very thoroughly discussed and recommendations given in the National Safety Council's Safe Practices pamphlet No. 34, entitled "Industrial Explosion Hazards"; also in the regulations of the National Board of Fire Underwriters, and in the pamphlet entitled, "Installations for Handling Gasoline and Similar Oils," issued by the Inspection Department of the Associated Factory Mutual Fire Insurance Companies. Only recommendations on methods not covered by the above pamphlets will be presented.

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Cements and other materials containing solvents are too numerous for discussion here, so all materials other than rubber cement will be omitted.

THAWING FROZEN BENZOL IN TANK CARS

Recommendations for receiving and unloading railroad tank cars are presented very completely in the regulations of the Bureau of Explosives in their folio No. 25-16-242-2. One important point, however, is not covered in their recommendations, viz., the thawing of frozen benzol in tank cars before it can be discharged into storage tanks. Evidently there is no method in use which may be considered entirely free from fire and explosion hazards. Perhaps the best method is to run the car into a heated shed constructed of fireproof materials, and with a roof which will easily be lifted without undue damage from any explosion that may occur. The tank car is heated by passing air through steam coils and delivered by a fan, located in a separate room, to the ceiling above the car,, and thence downward over the car to the floor and outward through openings in the walls at the floor line to the outside air. This circulation will free the shed from gases which may lie upon the floor. The heated air should not be recirculated, as this may build up an explosive mixture. This method seems preferable because the circulation of air produces perfect ventilation, while furnishing sufficient heat to thaw out the frozen liquid. Thrusting hot steam coils down into a frozen tank of benzol will produce explosive vapors very rapidly and is a very dangerous operation. There have been tank cars fitted with steam coils within the tank,, but these coils could not be kept in good repair, and the plan has been abandoned.

CONCRETE PIT UNDER TANK CAR UNLOADING TRACKS

It is recommended that a concrete pit be constructed under the railroad track where a tank car will stand while being emptied, so that in case of not being able to make a proper connection to the outlet underneath the tank, the contents or leakage will drop into the pit instead of flowing over the surrounding territory. From this pit there should be a sufficiently large pipe discharging into an underground tank of a capacity as great as the tank car. Proper construction of underground storage tanks and methods for storing in metal containers are very well specified in the above mentioned pamphlets.

DISTRIBUTION PUMPS FOR UNDERGROUND STORAGE TANKS

The safest method is to store these liquids in underground storage tanks and distribute from these tanks by pumps through pipes leading directly to points of usage. The underground storage tanks should be at the lowest point of the entire system, and all pipe mains should be laid to drain back to the top of these tanks. An extra drain tank with by-pass connections should be provided for draining the mains; so that if the main storage tanks are full or if there may be a break in one of the underground lines which would carry back sediment, the liquids may be drained into this extra tank. There should be no gravity feed from the storage tanks

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to any point of distribution, for in case a break or leak occurs in one of the mains, the entire contents of storage tanks might easily drain away.

The pumps should be located above the storage tanks. If there is more than one solvent or oil to be distributed, there should be a pump for each to reduce contamination and also a spare pump to care for breakdowns or other emergencies, and the valves and headers controlling the pump distribution should be so arranged that any pump may distribute any one of the liquids. The pumps should be set a sufficient distance above the floor of pump room so that sparks resulting from any friction of pump bearings, etc., will not ignite the heavy gases lying on the floor.

THE MOTOR ROOM

The motor and controls should be in a room separated from the pump room by a fire wall, the motor being preferably directly connected through this wall with a stuffing box or packing around the shaft to close the opening in the wall. A pressure regulator should be provided so that the maximum pressure carried in the mains will slightly exceed that actually required to distribute the liquids at the highest point of the system. This regulator ought to be constructed with electric switch, so that the pump will stop when the maximum pressure is reached. A signal system in the pump room to show which drawoff valve has been opened will assure the engineer in charge that it is proper for the corresponding pump to be in operation. Instances have been cited where a faulty electric connection has caused a pump to start, which produced a pressure in the mains or a circulation through the by-pass to such an extent that the motor seriously overheated. This might have gone on to the extent of burning out the motor or breaking one of the pipe lines, with consequent fire hazard.

DISTRIBUTING MAINS

The distributing mains to outlying draw-off stations should be buried underground below frost line in a bed of sand with slabs of concrete or stone above to prevent the pipes being broken by an uninformed workman making excavations. Benzol, which freezes at 42° F., should have its pipe mains insulated. This is probably most simply accomplished where most extreme temperatures are not encountered, by enclosing the main within another pipe, allowing sufficient air space around the main. Where the solvent mains are located within buildings, suspended to ceilings or risers to upper floors, each main should be enclosed within another pipe, so that any leakage in the main pipe will be carried by this outer pipe into sand pits outside of the building.

Each draw-off at outlying stations should be operated by a remote control valve, fitted with an electric switch, so that when valve is opened, the corresponding pump motor will start. The valve ought to be constructed so that it will close when workman removes his hand from handle, and so that the handle cannot be blocked or tied open. An automatic stop device may also be arranged in conjunction with a registering meter, so that at the option of the workman any pre-determined quantity can be discharged, and then the flow be automatically stopped. This device is

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especially desirable where solvent pipes are directly connected into tanks or mixers.

It is recommended that solvents used in mixers or similar equipment be carried directly into the equipment instead of drawing off the liquid into small containers. Where it is necessary to draw off solvents in small containers, the draw-off valve should be located within a fireproof enclosure, with an automatic closing fusible link controlled door and steam jets inside for smothering a fire. A sheet metal cabinet will make a very satisfactory and light weight enclosure and can easily be placed outside of the main building wall, if desired. The floor of this enclosure should be fireproof and drained into a sand pit outside of the building, and should always be free of trash and cotton waste.

CEMENT MIXERS

Cement mixers should be operated preferably by a gear drive and not by transmission belts, which cause static sparks. The mixer tanks should be tight, so as not to leak the liquid or gas, with the exception of an air vent leading to a point above the roof. The feed openings should be fitted with quick opening and closing doors. The openings into mixer tanks should not be left open when this equipment is not in use. Cement drawn from mixers should be placed in closed vessels. Cement is often placed in open tanks where articles are dipped into the cement and then placed in racks to dry. These open tanks should be placed within fireproof enclosures or cabinets with fusible link control doors. There should be plenty of ventilation from the surface of the cement to draw gases away from the workmen. The dry racks should be placed in a fireproof room with plenty of ventilation to carry away gases at the floor and explosive mixtures.

Gasoline and benzol are often kept in open vessels, such as tin cups, on work benches to be used for washing and cleaning stocks and for various other purposes. These vessels should be covered with a self-closing tight lid. Usually at the end of a work day or week, there remains a considerable quantity of solvent or cement in small containers, and it may not be possible or advisable to return them to the storage tanks. These containers should be stored in a fireproof room or preferably, in an outside shed, and not allowed to remain in the factory work rooms.

SOLVENT RECOVERY

Solvent recovery is carried out in a variety of ways in the rubber industry, among the most common being:

(1) Direct condensation by cooling.

(2) Condensation by compression and cooling.

(3) Absorption of vapors in proper absorbing agent.

The difference in handling solvent vapors when they are to be recovered and when they are not should be carefully noted. Where solvent vapors are to be recovered with greatest economy, the vapor concentration must be as high as possible, since the higher the concentration the higher the percentage of recovery. Where solvents are not recovered the very minimum vapor concentration will assure less fire and explosion hazard.

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The great hazard in solvent recovery is due to the fact that the highly concentrated vapors are gathered in an enclosed vessel, and sufficient air leakage into the vessel will form an explosive mixture with disastrous results.

CONDENSATION

Direct condensation by cooling is used principally on small equipment where impregnating is done in a small enclosed vessel, and where little solvent is required. The vapors are drawn from the vessel by a pump and forced at low pressure through coils cooled by water or ice.

Condensation by compression and cooling is probably most widely used. This method consists in enclosing the impregnating equipment in a tight compartment through which the fabric passes. The solvent vapors are drawn off by a compressor, which increases the pressure to such a point that little of the vapor remains after the compressed gas is cooled. In some installations gas, which will not support combustion, is drawn into the compartment and allowed to pick up the solvent vapors before passing on to the compressor and cooling coils. This gas is usually made in gas producers. There is a hazard in this type of equipment because the concentration of the gaseous vapors is high and air leakage into the vessels will form explosive mixtures. Within the last year two explosions of this nature have occurred, one of which resulted in the death of two men.

ABSORPTION OF VAPORS

Absorption of vapors in oil is accomplished by passing the solvent vapors through a petroleum oil of proper gravity. By redistillation the solvents can be recovered. This method is not so hazardous as those in which the gas is compressed.

The greatest precaution in solvent recovery is to maintain a vapor with a saturation considerably above or below the explosive range, and not permit air to mix with the vapors and build up an explosive mixture.

FIREPROOF ROOMS ESSENTIAL

It is essential that all equipment handling gasoline, benzol or rubber cements be housed in fireproof rooms. These rooms must be ventilated by supplying fresh air and exhausting gas-laden air from the floor surface. Usually a pressure can be set up by forcing air into the room and allowing it to escape with any gases through openings in the walls at the floor line and above outside grade. All door sills should be raised sufficiently to prevent the flowing of any liquids that may be on the floor to other rooms or areas.

FLOOR DRAINS

Floor drains as well as drains from mixer tanks, etc., must be provided to carry away the liquids as rapidly as required by building codes and insurance regulations. These drains should be carried to a cistern with the entering pipe below water level. Recommendations for construction of these cisterns are given in the pamphlets previously mentioned.

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FIRE EXTINGUISHING EQUIPMENT

It is important that plenty of fire extinguishing equipment be placed in rooms where flammable liquids are used. It is sometimes advisable to install a water sprinkling system within such rooms with the pipes dry inside of the room and controlled by a quick-acting valve placed outside of room. This would prevent water from the sprinkler heads flooding the floor and carrying volatile liquids to other areas, and it would also allow the water to be turned on if advisable. Sufficient hand extinguishers, etc., should be provided for small fires. Perhaps the best method of extinguishing fires from these liquids is by steam quenching, but this cannot be accomplished except in a tightly enclosed room. A worthy scheme for closing the windows and doors automatically is by fusible links which also open the steam valve. Another excellent extinguisher distributes foam which contains an inert gas. This foam forms a blanket over the burning and flammable materials. A quantity of sand, soapstone or other nonflammable material should be placed in such rooms for absorbing liquids which might otherwise flow to other areas.

While it is positively compulsory to prohibit fires and sparks near solvents and cements, it must be admitted that hazards resulting from their presence are due in a great measure to equipment and poorly designed housing. Proper equipment would handle these volatile materials in tightly enclosed vessels with no openings for contact with sparks, and providing proper workroom ventilation to avoid explosive mixtures.

CHAIRMAN FITZGERALD: We will now have the report of the health hazards committee:

REPORT OF THE COMMITTEE ON HEALTH HAZARDS

C. F. HORAN, HOOD RUBBER COMPANY, WATERTOWN, MASS., CHAIRMAN

I have wondered, after hearing Dr. Weber the other day, whether the members of this Section would be interested in receiving an outline of the symptoms of the dangerous materials that we use. It will take a little time and some work to get out a book on the diagnosis of rubber industry occupational diseases, but if the members felt that it might be of some assistance to them, I know the committee would be glad to get busy and get out such a report.

Because of the fact that the work of this committee has had to deal with new and untried fields, plus the responsibility of dealing in many cases with secret processes of the various members, it has been considered advisable to render individual reports to the members, rather than publish general bulletins.

During the past year studies have been made of the following materials used in the rubber industry and problems: Xylol, toluol, benzol, solvent naphtha, lead, antimony, thiocarbanalide, aniline, dangers from vapor cures, sulphur chloride, hexamethylene tetramine, carbon tetrachloride vs. disulphide, soapstone dusts, and dermatitis from shoe stains.

The reports concerning these investigations have been filed with the members requesting specific information.

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DANGERS OF LEAD POISONING

Inquiries have been received from several members concerning the real dangers of lead poisoning to employees who handle leaded stock after it is mixed, and who are not exposed to the dust hazards of the mixing and compounding rooms. The committee has undertaken a series of chemical experiments along the lines outlined and has concluded that it is practically impossible for a cutter, or boot-maker or other employee not exposed to the hazards of mixing, to contract lead poisoning as a result of his occupation. The liability to lead poisoning from mixed stocks would seem to depend greatly on the degree of acid or alkaline reaction of the individual's sweat; persons with either greatly acid or greatly alkaline sweat may receive an occupational poisoning from their work, but the possibilities of finding employees whose sweat is sufficiently abnormal are so remote as to justify the opinion that danger from this source does not normally exist.

Your committee has co-operated with the Rubber Institute of America in publishing a resumé of literature on the matter of benzol poisoning.

ORGANIC ACCELERATORS IMPROVED

Quite a decided improvement has been noted during the year in the matter of organic accelerators. Your committee has been instrumental in obtaining some direct action by manufacturers of accelerators, especially manufacturers of the aniline group. A number of less hazardous accelerators of this type are now being placed on the market and it is to be expected that these new accelerators will gradually replace the more dangerous compounds now being used. Apparently the best of these newer accelerators is akbar, which has been developed by the Fisk Rubber Company. As I understand it this is somewhat of a secret compound and is not purchasable by other rubber companies.

RESEARCH WORK FOR COMING YEAR

The department of biology and public health of one of the largest eastern colleges has accepted the subject of: "The Bacteriology of Rubber From a Public Health Standpoint," for research work. An experienced bacteriologist will be assigned to this work by the college, and the experiments will be conducted under the supervision of this committee. It is to be hoped that this research will indicate whether or not boils and carbuncles may be caused by raw rubber.

Members of the section who are confronted with special problems in industrial hygiene are invited to make use of the facilities which this committee has to offer them.

CHAIRMAN FITZGERALD: I feel that this section certainly ought to compliment Mr. Horan on the work of the committee and should accept his offer to get out such a pamphlet to our concerns.

(The reports of the bulletin, membership, and program committees were presented and unanimously approved.)

CHAIRMAN FITZGERALD: We will now have the privilege of hearing Mr. Whittelsey.

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SAFETY FIRST FROM THE FACTORY MANAGER'S VIEWPOINT

CHARLES B. WHITTELSEY, PRESIDENT, THE HARTFORD RUBBER WORKS COMPANY, HARTFORD, CONN.

The function of a factory manager is to produce an article of the highest quality in the greatest quantity at a minimum cost. The principal means at his command for producing are equipment, material and labor; and it is the problem of saving the lives and limbs of his laborers that is the subject of this paper.

FACTORY MANAGER MUST FIRST BELIEVE IN SAFETY—

To consider the factory manager's viewpoint of safety we must assume that he has already been sold on the proposition and fully realizes the importance of safety in relation to his problem of obtaining high quality and maximum quantity at minimum cost. He must believe in Safety First both from the humane and from the economical viewpoints, and to such an extent that he has its problems always before him.

—AND THEN SELL SAFETY TO EVERY OTHER MAN IN PLANT

Fundamentally, the problem resolves itself into the task of selling the idea of Safety First to every man in the organization. It is just as necessary to sell this idea to the workman as it is to provide him with the right materials and the proper tools.

But the factory manager requires patience. He must not forget that the process by which he—one of the minority of factory managers—learned that accidents are really preventable, was exceedingly slow. He must remember that the minds of his foremen and workmen are fixed on turning out production and not on the numerous details incidental to that production. He has but to look back and see how he felt after he first placed guards around belts, gears, saws and knives, covered openings in floors, and installed gates on elevators, etc., thus reducing the percentage of accidents, to realize that his entire organization, from superintendents to sweepers, must be sold on this proposition before the satisfactory results of a safety campaign can appear.

The factory manager, then, must, first of all, understand that Safety First is an educational movement, and that from 70 per cent to 80 per cent of the accidents in industry are due to lack of proper training of the operators.

BEST MEDIUM OF REACHING MEN IS THROUGH FOREMEN

The best medium the factory manager has for reaching his workmen is through the foremen, and therefore the foremen must be sold on safety. In many cases a foreman assumes that because every belt, gear, and machine in his department has been safeguarded, his work in the safety campaign is finished.

But the factory manager must make sure that the foreman's education

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is carried still further. The foreman must be shown the necessity of studying the personnel of his department, because men of a congenial type work better and more carefully together. He should see that all minor accidents such as cuts and bruises, are investigated, and the operator carefully instructed so that similar accidents may be avoided in the future.

The foreman must be brought to realize the importance of safety instructions from the economic standpoint. An operator who has been fully instructed in his work feels assured that, by doing his work correctly, he will avoid injury; he is certain to be more content, and consequently in a better mental and physical condition, and works more efficiently and to his utmost earning capacity. This favorable condition results in high quality, uniformity, maximum quantity, and low cost to the company.

But the foreman must think beyond production and see the human side of the question. By his careful instructions on safety, he reduces the amount of suffering and disability among his men, prevents them from losing time, and saves their families from distress, thus proving himself not only a faithful servant of the company but a true friend to his men.

EMPLOYMENT DEPARTMENT CAN ASSIST IN REDUCING ACCIDENTS

The factory manager finds that his employment department can be of great assistance in reducing the number of accidents, if the employment manager is thoroughly familiar with the operations in the various departments in which he is to place men.

The factory manager will soon see a shorter accident list if his employment manager makes a careful analysis of each job, and uses this analysis in his placing of employees. The wise selection of employees is of prime importance; but the careless placing of light men on heavy jobs and heavy men on light jobs, the putting of men of muscle and brawn in positions where brains and dexterity are required, is a most fertile source of accidents.

Another valuable ally in the factory manager's safety campaign is the first-aid department. Every injury, no matter how slight, should be reported to the first-aid department, so that it may receive proper treatment and serious results may be prevented.

The first-aid department should maintain complete accident records in which each accident is traced back to its actual cause. The statistics thus accumulated will be of great value in determining the chief causes of accidents, and will serve as a guide to the factory manager in planning his safety campaign.

The first-aid department should, of course, be under the direction of medical authorities, with trained nurses in attendance. Heavy losses often occur from the lack of proper first-aid attention.

OFFICERS OF COMPANY MUST BE CONVINCED

Sometimes the factory manager discovers that, though the officers of his company desire to reduce accidents, they are unwilling to spend

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sufficient money to carry on the educational work after the mechanical safeguarding devices have been installed. Under such circumstances the factory manager's efforts are in vain until he has changed the direction of his program of education from his foreman to the officers and directors of his company. But let him see to it that when he goes to his board of directors he arms himself with telling statistics and indisputable facts well backed up with quenchless enthusiasm for Safety.

In conducting the safety campaign, the factory manager requires a right-hand man to whom the actual details of the work may be entrusted. From what department this man is chosen matters little, provided he possesses, in addition to his other qualifications, the supreme gift of leadership.

The safety director need not devote all his time to the campaign, but upon him devolves the duty of organizing a *live* safety committee through which the educational work is carried throughout the plant.

This committee must be allowed time to inspect the various departments and to get in touch with the foremen. It is not to be expected that the members of this committee can do their work effectively unless they have an opportunity to inform themselves on the subject; therefore all available literature dealing with the prevention of accidents should be placed by the company in the hands of the committee.

Upon the safety director and his committee rests the important work of so infusing the safety first idea into the minds of the foremen, and through the foremen, into the minds of the operators, that a spirit of hearty co-operation will be engendered.

By inducing the foremen to set up a friendly rivalry among departments in their efforts to reach the zero mark in accidents, and by stimulating department pride, it is possible to inject the new ideas into the operators' minds so that they respond to the safety suggestions without the irritating sense of being compelled to obey a set of rules. By such means the habit of carefulness is continually cultivated until it becomes second nature.

IMPORTANCE OF PROPER INSTRUCTIONS

I would like to depart from my paper to say that I want to bring to the mind of each of you gentlemen here the importance of proper instructions. I have been so impressed, lately, with the importance of proper instructions from the management to the operator, that I feel we should all put ourselves in the position of the manager and take more pains to see that the proper instructions reach the operator, and educate him so that there is not the likelihood of accident, because when he is properly instructed, the likelihood is almost nil. I realize the difficulty of getting proper instructions to all the classes of labor that we have to deal with. Nevertheless, it is our duty to give more time to this safety work and I assure you, as a result of this meeting, I shall give much more time to it than I have, because I see the need of it and I see the need of helping you push this work along to the point where it reaches more of the factory managers, so that the officers of the company realize that the neglect of this is simply increasing the cost of their product and endangering the lives of their working people and that they should be

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brought in closer contact with the National Safety Council and help it along with its work.

The factory manager recognizes the valuable service of the National Safety Council in this great educational work. The records show that even though the membership includes nearly 4,000 employers and almost 6,000,000 workingmen, it does not represent more than 25 per cent of those who should be members and should receive the great benefits that result from the work of this national organization.

When the other 75 per cent is added to the membership of the National Safety Council, and when the spirit of Safety First spreads not only throughout every industry in this land, but into our streets and our highways, out to our farms and into our dwellings, then, and not till then, will the factory manager's complete ideal be attained.

MR. ROSE (Cumberland, Md.): Mr. Whitelisey's address and his impromptu remarks are to be considered as a classic in rubber literature, and of tremendous value to this section, if we make the best use of them. I want to make a motion that the Rubber Section have Mr. Whittelsey's remarks published and sent to the factory managers of the entire rubber industry, with a note that it is not to be passed on to the safety director until they, themselves, have read it.

(The motion was seconded and carried.)

CHAIRMAN FITZGERALD: Before closing the work of this section for this year, we are going to hear from Mr. Baker.

RECLAIMING PLANTS AND THEIR EFFORTS TOWARDS SAFE OPERATION

JOHN C. W. BAKER, MASTER MECHANIC, RUBBER REGENERATING COMPANY, NAUGATUCK, CONN.

There is a similarity between reclaiming and other rubber plants, notably so in the arrangement and equipment of the mill room. We have the same style of mills driven individually, or in groups; the mill operator is protected against accident by an approved magnetic, mechanical or pneumatic clutch on each mill line shaft, with some form of brake, the clutch is thrown out and the brake engaged by the conventional trip over each mill.

The similarity is not so pronounced outside the mill room, there being some features connected with reclaiming that require careful consideration for safe operation. One of these features is the handling of materials. Wherever possible, rubber in process is conveyed by power or by gravity, but there is always more or less trucking by hand, and this trucking and handling of materials accounted for 43 per cent of the accidents in one plant for one year. The general run of these accidents was slight, to be sure, but occasionally a bad strain was the result, a foot bruised or a toe crushed. Many of these accidents could have been avoided if electric transveyor trucks had been in use; these are rapid in action and considering the number of hand trucks they replace, safe in operation. The inclination is to overload them. It is, therefore, impor-

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tant before the trucks are placed in service to look into the condition of the floors to determine if they are sufficiently strong to carry the additional concentrated load.

HANDLING RAW STOCK

A large stock of raw material must be available at all times. It is received in a variety of bales, bags, boxes and in loose condition. Bales, weighing from 1,200 to 2,400 lbs., are packed tightly in the cars, and their removal has been a safety problem for the operators, which has occasioned considerable discussion. Many ways and means have been suggested, but as yet, nothing has been found to supersede the hand bale truck.

Most of the raw stock is stored in the open, thus reducing the fire risk, and avoiding the use of large buildings for storage purposes. The storage pile should be served by a light traveling or stacking crane, or a monorail conveyor.

SAFEGUARDING EQUIPMENT

In regard to equipment: Devulcanizers and jacketed digesters are provided with safety valves, the same as the safety standards for vulcanizers. Digesters of the single shell type, where the steam comes in contact with the rubber and caustic, will, at times, due to chemical reaction, run a higher temperature, and consequently pressure, than that furnished by the boilers. To protect the vessel, a safety valve is placed in the entering steam pipe and close to the stuffing box; check valves between the safety and steam valves prevent the excessive pressure generated in the digester from blowing the rubber and caustic into the steam main, and thence to boiler. The reason for locating the safety valve in the pipe, rather than in the shell, is that, in the former position, it can be tested while the digester is revolving; it also keeps free from an accumulation of rubber, whereas a valve in the shell would soon become plugged and rendered inoperative.

Revolving digesters and devulcanizers should be provided with locks to prevent their turning while being repaired or cleaned. A satisfactory lock is the ratchet and pawl type. The ratchet is made in halves and bolted to the trunion of the digester; to operate, the pawl is simply thrown over to engage the ratchet teeth. A brake has been used for the same purpose but it was found that operators failed to clamp it tight enough to prevent turning.

Tubing machines, or, more properly speaking, straining machines, as the latter only are used in reclaiming, are provided with a straining head, which, for an 8 inch machine, weighs approximately 100 lbs. The head is screwed into the body of the machine and has to be changed several times during the course of the day for the purpose of cleaning the screen.

PROPER WRENCH NECESSARY TO SAFETY

The style of wrench used to remove the head is important; a spanner or box wrench will in time slip, due to the rounding off of the corners of the head, or the corresponding corners of the wrench, often resulting in an injury to the operator.

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A wrench with a friction grip, similar to a Parmelee pipe wrench, can be used with a greater degree of safety than any other style. It will tightly grip without marring the smooth cylindrical surface of the head, and as it requires no protuberances to fit over, the head can be of minimum weight, consequently more easily and safely handled.

For several years past there have been no accidents due to the operator's hand or fingers being caught between the worm and the body of the machine. To prevent accidents of this nature, a practice is made of using a stick to feed the stock, or for the operator to keep his thumbs outside the throat, thus preventing his fingers from coming in contact with the worm.

BUCKET ELEVATORS AND CONVEYORS

Bucket elevators and conveyors of all kinds should be provided with locks. The usual method is to lock the belt shipper or handle of starter if driven by motor, and the man cleaning or repairing the conveyor keeps the key in his possession. Screw conveyors under the floor, or at bins at feeding points are provided with bars, spaced far enough apart to admit stock, but too close for the operator's foot to slip through if by chance he should step on them.

Batching and sheeter mills are now equipped with automatic aprons. With mills so equipped, it is not necessary for the operator to keep his hands on the rolls, thereby reducing the number of mill accidents. In some cases, mills are arranged in groups and connected by conveyors. For instance, if a certain stock requires four passes, it is fed to the first mill, and automatically delivered to the other three. This arrangement, similar to the automatic aprons, dispenses with the dangerous practice of feeding by hand.

HANDLING CAUSTIC AND ACID

Three per cent of the total injuries during one year in one plant were caused by caustic or acid burns; the record does not give the proportion, but the former predominated. The usual method of opening the caustic drums or containers is by means of a sledge-hammer, or pickaxe; the caustic is broken in the same manner.

A pneumatic rock drill permanently supported, with a hammer in place of the drill, has been used with some success, but as yet it has not been determined as to how it compares from a safety point of view with the old method of breaking with a sledge.

Sulphuric acid is received in tank cars and is delivered to the storage tanks by gravity or by compressed air, and pumped from the storage to the boiling tanks. In all cases it is piped. Carboys, or other containers, with their attending danger of handling, should not be tolerated.

These constitute some of the distinctive features in reclaiming. There are other operations requiring equipment bearing a resemblance to that used in all rubber plants, to which the same standards of safety can be applied.

CHAIRMAN FITZGERALD: I now have the pleasure of presenting to you Mr. Harold T. Martin of The Fisk Rubber Company, who will be Chairman of this Section for next year.

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MR. MARTIN: It is needless for me to say that during the coming year I shall do my best. My heart and soul are in the future of this section and I ask only for your co-operation.

I have appointed the following committee chairmen: Engineering—C. B. Mitchella, B. F. Goodrich Company; Health Hazards—C. F. Horan, Hood Rubber Company; Membership—E. L. Hewitt, United States Rubber Company; Program—Sidney Schott, United States Rubber Company, Morgan and Wright Division; Standards and Statistics—E. W. Beck, United States Tire Company; Bulletin Committee—E. A. Hoener, Firestone Tire and Rubber Company; and a new committee on Safe Practices—E. H. Fitzgerald, Federal Rubber Company.

I thank you, gentlemen, for the confidence you have placed in me and pledge myself to do the very best I know how.

ADJOURNMENT.

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Steam Railroad Section

September 27-30, 1921

THOMAS H. CARROW, Chairman
Supervisor of Safety, Pennsylvania System, Philadelphia

H. A. ADAMS, Vice-Chairman
Assistant to the General Manager, Union Pacific Railroad, Omaha, Neb.

A. V. ROHWEDER, Secretary
Supervisor of Safety, Duluth, Missabe & Northern, and Duluth & Iron Range Railroads, Duluth, Minn.

IN ATTENDANCE AT THE STEAM RAILROAD SECTION MEETINGS

ANN ARBOR—
V. Parvin, Superintendent, Owosso, Mich.
ATCHISON, TOPEKA AND SANTA FE—
Isaiah Hale, Safety Superintendent, Topeka, Kans.
A. E. Hutchison, Inspector and General Assistant, Safety Department, Galveston, Texas.
ATLANTIC COAST LINE—
John R. Adams, Supervisor of Safety, Wilmington, N. C.
H. S. Corbin, Supervisor of Safety, Wilmington, N. C.
Robert Scott, Superintendent of Insurance and Safety, Wilmington, N. C.
BALTIMORE AND OHIO—
W. L. Allison, Safety Agent, Chillicothe, O.
Wm. F. Braden, Safety Representative, Baltimore.
John T. Broderick, Superintendent Safety Department, Baltimore.
C. W. Galloway, Vice-President in Charge of Operation and Maintenance, Baltimore.
CHICAGO, ROCK ISLAND AND PACIFIC—
Wm. J. Head, Safety Agent, Cleveland.
Wm. D. Lenderking, Safety Agent, Baltimore.
E. R. Scoville, Supervisor of Safety, Baltimore.
BESSEMER AND LAKE ERIE—
F. R. Layng, Engineer of Track, Greenville, Pa.
C. J. Ramsay, Safety Inspector, Greenville, Pa.
T. C. Whiteman, General Attorney, Greenville, Pa.
BOSTON AND ALBANY—
M. O. B. Campbell, Chairman, General Safety Committee, Boston.
BOSTON AND MAINE—
A. A. Stebbins, Assistant, Safety Department, Boston.
S. G. Watkins, Secretary, Safety Department, Boston.
BUFFALO, ROCHESTER AND PITTSBURGH—
J. P. Rockwell, Safety Agent, Rochester, N. Y.
CHESAPEAKE AND OHIO—
L. G. Bentley, General Safety Agent, Richmond, Va.
J. R. Dawson, Safety Inspector, Richmond, Va.
D. E. Satterfield, Safety Inspector, Richmond, Va.
W. H. Ganzert, Safety Inspector, Richmond, Va.
CHICAGO, BURLINGTON AND QUINCY—
E. M. Switzer, Superintendent of Safety, Chicago.
CLEVELAND, CINCINNATI, CHICAGO AND ST. LOUIS—
T. R. McCampbell, Supervising Safety Agent, Indianapolis, Ind.

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CHICAGO GREAT WESTERN—
C. L. Bent. Claim Agent, Clarion, Ia.
T. W. Fatherson, Superintendent, Clarion, Ia.
E. E. Stoup, Superintendent, Oelwein, Ia.
CHICAGO JUNCTION—
T. F. Barry, Safety Supervisor, Chicago.
CHICAGO AND NORTHWESTERN—
D. M. Leavitt, Road Foreman of Engines, Oak Park, Ill.
Paul Ropinske, Blacksmith, Chicago.
M. A. Schuster, Air Brake Foreman, Milwaukee, Wis.
J. C. Spellman, Road Master, Norfolk, Nebr.
James Sullivan, Safety Inspector, Chicago.
W. E. Warnes, Eagle Grove, Ia.
CHICAGO, ROCK ISLAND AND PACIFIC—
L. F. Shedd, Supervisor of Safety and Fire Prevention, Chicago.
CHICAGO, ST. PAUL, MINNEAPOLIS AND OMAHA—
George Wright, Superintendent of Safety, St. Paul, Minn.
THE DELAWARE AND HUDSON—
R. C. Helwig, Safety Agent, Albany, N. Y.
J. E. Long, Superintendent of Safety, Albany, N. Y.
Harry G. Stevens, Safety Agent, Albany, N. Y.
DELAWARE, LACKAWANNA AND WESTERN—
H. A. Rowe, Secretary, Central Safety Committee, New York City.
DENVER, RIO GRANDE, WESTERN—
Arthur Ridgway, Safety Officer, Denver, Colo.
DULUTH AND IRON RANGE—and
DULUTH, MISSABE AND NORTHERN—
G. J. Barrett, General Claim Agent, Duluth, Minn.
A. V. Rohweder, Supervisor of Safety, Duluth, Minn.
ELGIN, JOLIET AND EASTERN—
O. F. Gnadinger, Supervisor of Safety, Joliet, Ill.
GREAT NORTHERN—
C. L. LaFountaine, General Safety Supervisor, St. Paul, Minn.
GULF, COLORADO AND SANTA FE—
J. G. Fitzhugh, Galveston, Texas.
ILLINOIS CENTRAL—
S. S. Morris, Chairman, General Safety Committee, Chicago.
LEHIGH VALLEY—
F. Hartenstein, Assistant to General Manager, Bethlehem, Pa.
LONG ISLAND—
T. P. Brennan, Safety Agent, New York City.
MICHIGAN CENTRAL—
W. L. Boslooper, Safety Agent, Detroit.
MISSOURI, KANSAS AND TEXAS—
C. F. Colby, Safety Agent, Dallas, Texas.
J. L. Walsh, Superintendent of Safety, Dallas, Texas.
MISSOURI PACIFIC—
M. McKernan, Superintendent of Safety, St. Louis.
MONONGAHELA—
T. L. Stokes, Chief Clerk and Secretary of Safety Dept., Brownsville, Pa.
NEW YORK CENTRAL—
F. L. Diehl, Safety Agent, Elkhart, Ind.
M. A. Dow, General Safety Agent, New York City.
Chas. W. Hammond, Safety Agent, Cleveland.
C. D. Shaff, Safety Agent, Syracuse, N. Y.
NEW YORK, CHICAGO AND ST. LOUIS—
E. M. Mann, Chief Safety Agent, Cleveland.
NEW YORK, NEW HAVEN AND HARTFORD—
F. A. Barrows, Transportation Inspector, New Haven, Conn.
H. A. Clancy, Safety Inspector, Boston.
E. M. Harris, Safety Inspector, New Haven, Conn.
Warren Jacobs, Stock Clerk, Boston.
F. W. Mitchell, Superintendent of Safety, New Haven, Conn.
NEW YORK, ONTARIO AND WESTERN—
N. L. Satchell, Safety Agent, Middletown, N. Y.
NORFOLK AND WESTERN—
C. H. Blakemore, Superintendent of Safety, Norfolk, Va.
NORTHERN PACIFIC—
F. M. Metcalfe, Assistant to General Manager, St. Paul, Minn.
NORTHWESTERN PACIFIC—
William S. Wollner, General Safety Agent, San Francisco.
OREGON-WASHINGTON—
John F. Grodzki, General Safety Agent, Portland, Ore.
PENNSYLVANIA LINES—
John N. O. Byle, Service and Safety Agent, Sunbury, Pa.
T. H. Carrow, Supervisor of Safety, Philadelphia.
F. S. Chapin, Safety Inspector, Philadelphia.
T. J. Curtin, Safety Agent, New York City.
W. H. Fassett, Safety Agent, Philadelphia.
H. E. Meginnis, Safety Agent, Terre Haute, Ind.

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PHILADELPHIA AND READING—
Joseph T. Pratt, Supervisor of Safety, Reading, Pa.
PITTSBURGH AND LAKE ERIE—
F. H. Babcock, Safety Agent, Director of First Aid, Pittsburgh.
SEABOARD AIR LINE—
W. W. Fuller, Safety Supervisor, Royster Bldg.. Norfolk, Va.
SOO LINE—
L. P. Green, Superintendent of Safety, Minneapolis, Minn.
SOUTHERN PACIFIC—
H. M. Mayo, Superintendent of Safety, Houston, Texas.
TORONTO, HAMILTON AND BUFFALO—
W. J. Orr, Safety and First-Aid Officer, Hamilton, Ont., Canada.
UNION PACIFIC—
H. A. Adams, Assistant to General Manager, Omaha, Nebr.
T. A. Flanagan, District Foreman, St. Joseph, Mo.
J. Gogerty, District Foreman, Junction City, Kans.
J. M. Guild, Nebraska Division, Safety Agent, Omaha, Nebr.
Wilkie Hodgson, Machinist, Denver, Colo.
A. R. Hutchison, Boilermaker, Kansas City, Mo.
Louis Ihm, Machinist, Omaha, Nebr.
J. E. Mulick, Assistant Superintendent, Nebraska Division, Omaha, Nebr.
E. G. Neumann, Superintendent's Chief Clerk, Denver, Colo.
W. L. Richards, Engineer, North Platte, Nebr.
G. A. Smith, Conductor, Kansas City, Mo.
C. E. Stevens, Machinist, Cheyenne, Wyo.
W. S. White, Brakeman, Evanston, Wyo.
WABASH—
D. G. Phillips, Superintendent of Safety, St. Louis.
WHEELING AND LAKE ERIE—
J. T. Briggs, Conductor, Massillon, O.

Edward L. Bair, Vice-President, Benefit Association of Railway Employees, Chicago.
C. Drake, Arlington Heights, Ill. (Engineer.)
M. F. Dunn, Bangor, Me.
Reverend Walt Holcomb, Minister, Cartersville, Ga.
Joseph Marshall, Special Representative, Freight Claim Prevention, American Railway Association, Chicago.
John F. Moore, Associate General Secretary, International Committee, Railroad Y. M. C. A., New York City.

TUESDAY MORNING SESSION

THE first session of the Steam Railroad Section was called to order at 10:30 a. m. by Chairman Thomas H. Carrow. After roll call the reports of the officers and committee chairmen were presented and accepted. Chairman Carrow then introduced Mr. John F. Moore as the first speaker.

SAFETY FIRST—FROM A MORAL VIEWPOINT

JOHN F. MOORE, ASSOCIATE GENERAL SECRETARY, INTERNATIONAL COMMITTEE, Y. M. C. A., NEW YORK CITY

This is an old, old question. In the early days among the ancient Jews it was recognized, for you will find in the Book of Deuteronomy a statement to this effect, that "when thou buildest a new house, then thou shalt make a battlement for thy roof, that thou bring not blood upon thy house, if any man fall from thence."

That principle of safety was imbedded in the old Mosaic law five thousand years ago, yet though this is an old question, there is a sense in which it is a very new question.

Only a short time ago I was crossing Forty-fifth Street in New York, when I was stopped by the president of a very important railroad, a man

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I have known many years. He began to talk of the disordered industrial conditions of these days, and said: "Mr. Moore, I see no hope for the future except in so far as we are able to bring the moral force of righteousness to bear upon present-day industrial conditions."

Now, this man was not a religious leader. He would never pretend religious leadership, but as a keen, thoughtful leader in the railroad world today he saw that you could only solve the industrial problems that face us by moral means.

I do not pose as an authority on safety, yet I venture to say that I may be within the bounds of reason if I make this statement—if you were to divide the accidents that cost life and property, you would do so roughly in four groupings.

First, there are those that have their genesis in what we call physical causes, largely beyond human control—the split rail or broken axle. Second, those causes that are primarily due to man failure—you know what they are. Third, those causes in which the physical and man failure are combined. And finally, those relatively few accidents caused by what are called in law "acts of God"—the tornado that sweeps over the country, or the great storm that works disaster to men and to goods.

Am I not right in the assumption that the great majority of accidents arise from the second and third causes—man failure and physical causes combined? If I am right in that assumption, then I am right in my further deductions concerning the moral viewpoint of this highly important question.

Gentlemen, I feel we ought to spend a moment in defining the term "moral". We need to define it for three reasons. First, because there is so much confused thinking about it. I wish I could show you the file of letters I have gathered on this topic. Then you would understand what I mean by saying that among thoughtful men there is a great confusion as to the interpretation of the term "moral". That is one reason why we need a clear definition.

A second reason is that a surprising number of men give to the term "moral" a narrow interpretation. To many it recalls simply the baser faults of men. We need to change that impression.

In the third place, the definition is the foundation of what I have to say.

I therefore turned to three dictionaries, the Standard, the Century and Webster's. Let me read an extract from one which covers what I have in mind: "Moral—pertaining to the practices, conduct and spirit of men toward God, themselves and their fellow-men, with reference to right and wrong, and to obligations to duty."

In this definition the term "moral" stands out as a sunlit peak of thought and inspiration, and we can turn our thought upon this question in a large and wholesome way.

THREE MORAL QUALITIES OF SAFETY

Why do I believe that safety has a moral viewpoint? Well, because it deals with three great moral qualities. First it deals with character;

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second, it deals with the preservation of life and property; third, it is related to the six fundamental responsibilities of all men.

Let me explain very briefly. First, it is related to character. Near Boston there is a gifted man known far and wide—Roger Babson, a man who is one of the best students of men. Recently he made an address on industrial conditions. A brief extract from that address will put before you clearly all that I have in mind. Mr. Babson said, "The trouble with industry is this: it has been adding stories to the building without changing the foundation. It has erected a ten-story building on a one-story foundation. Instead of building more stories, industry needs to strengthen the foundation. Now, the foundation of all real progress in industry and elsewhere is the character of the men, both employers and employees."

And, gentlemen, you can never in God's world solve this problem of safety if you overlook that vital fact. Only as you strengthen your own characters and only as you help by your work to strengthen the characters of other men will you be able to meet the grievous conditions of these days and point the way to that better day that is to be. And so I say that, because you deal with character, this is a moral movement.

Again, because you deal with the preservation of life and property, upon which two foundations rests the structure of our democratic institutions. Take away property and take away life and you are failing. You are dealing with a vital moral problem.

SIX FUNDAMENTAL RESPONSIBILITIES OF EVERY MAN

Again, you are dealing with the six fundamental responsibilities of every man—first, his duty to himself; second, his duty to his family; third, his duty to his fellow-employees; fourth, his duty to the company that employs him; fifth, his duty to the community of which he is a part; and sixth, his duty to the God who gave him life.

You are dealing with these six fundamental responsibilities of every man. Let me briefly state them. You are dealing with a man's responsibility to himself. A young man enters the railroad service at the age of twenty. According to actuarial estimates, that man's expectation of life should be forty-two years—he should live until he is at least sixty-two years old. He is entitled to expect for that period of time the joys of living.

Now, suppose that man through some willful act of carelessness deprives himself of life or of limb—then that man has done a moral injustice to himself.

Or, again, take a man's relations to his family. Marriage is a sacred contract. A man, when he marries, agrees to certain obligations, the woman agrees to certain obligations. She will be his helpmate, she will bear and rear his children, she will be his friend and his companion in the joyous years of life and down into the Valley of Shadows. And the man assumes certain responsibilities; he will support that family, he will give it food and shelter, he will do what he can to see his children reared to manhood and to womanhood. When that man, through some accident

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that might without much trouble have been prevented, brings upon himself disaster or death, he robs his family, he violates his sacred contract, he commits a moral wrong.

Take a man's relations to his fellow-men, his fellow-employees. Is it not true that our lives are interwoven, that we are dependent upon each other? Edwin Markham put it beautifully, in this way:

> " 'Tis destiny that makes us brothers
> None goes his way alone;
> All that we send into the hearts of others
> Comes back into our own."

Here is a young railroad man. He takes a chance. He gets by with it—but wait, there is a friend of his over yonder. He sees him get away with it, and says, "If he can do it, I can." He tries and fails. Disaster comes. Who is to blame? Again we are in the realm of morals.

So, I might further show how this question affects a man's relation to the corporation that employs him, to the community of which he is a part, and which trusts him, and to the God who gave him life. Long ago, this question came from the mouth of a prophet, "Will a man rob God?" I want to say that when God has given a man the inestimable boon of life and set him here so that he may make the world a better place in which to live, if that man, through causes preventable, loses his life or incapacitates himself, he commits a moral wrong; and he robs Almighty God.

For these three reasons, I submit we face a moral question in safety: because it deals with character; because it has to do with the preservation of life and property, and because it is related to the six fundamental responsibilities of every man.

Passing from the general to the specific, some moral defects that lead to man failure are: first, the wrong use of leisure; second, a false sense of loyalty; third, the aftermath of evil; fourth, the breaking loose from old moorings; fifth, ignorance; sixth, mental and physical sluggishness; seventh, marital infelicities; eighth, indifference.

TEN CORRECTIVES FOR MAN FAILURE

I will close by calling your attention to the correctives. First, we should stand for the recognition of the moral element in safety. Second, we should use our influence to see that greater care is taken in the selection of men. Third, we should show more interest in men as individuals. Fourth, we should magnify the importance of each man's task. Fifth, we should aim to establish the family spirit. Sixth, we should promote every good, wholesome influence in every railroad community. Seventh, we should provide for men away from home. Eighth, we should stand for fair play, a reciprocal application of the Golden Rule, applying alike to employer and employee. Ninth, we should encourage home ownership. Tenth, enlarge and strengthen safety work.

Gentlemen, yours is a great work. I know of none save my own to which my heart turns with more fullness.

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You live to give the season
  By gifted men foretold,
When man shall live by reason,
  And not alone by gold;
When man to man united,
With every wrong thing righted,
The whole world shall be lighted
  As Eden was of old.

CHAIRMAN CARROW: I want to say to Mr. Moore that it is a satisfaction to those of us who are engaged in the safety movement to know that practically all of our officials appreciate the principles he has so clearly reviewed. We thank you sincerely, Mr. Moore.

When I was a boy, a gentleman who had a great reputation in the South was Sam Jones. I have the honor and the pleasure of introducing a son-in-law of Sam Jones.

I have the pleasure of introducing the Rev. Mr. Walt. Holcomb.

ADDRESS

REV. WALT. HOLCOMB, EVANGELIST, CARTERSVILLE, GA.

It is always a difficult thing to get by, having a famous father-in-law; it is so hard on the son-in-law.

As I have also been introduced as a minister, I shall ask the privilege of taking a text, with the promise that I won't preach. A text is a preacher's self-starter, and sometimes they get hung up. The text is: "Is the young man, Absalom, safe?"

This is a distressed call of the heart for the saving of one bound to another by the ties of family affection. It is also the war cry of a solicitous father for the safety of his son on the battle-field.

Man has never been absolutely safe, but he has an inborn instinct to be as safe as possible. The people living in the mountains in Kentucky and Tennessee can still be found prowling around their native hills with their rifles under their arms. Notwithstanding that self-preservation is the first law of nature, there is a natural impulse in man to take a chance.

If Adam was the first man, he took the first chance and raised Cain, and we have been raising the Devil ever since. His own son took the next chance, and it resulted in the death of his brother, and to this good day we are thoughtlessly running risks when limb and life are at stake.

Here is the paradox of safety: At one moment, we are the calm, careful, cautious Dr. Jekyll, and the next moment the careless, criminal, chance-taking Mr. Hyde. We are swallowing thrill pills and being overtaken by the great final accident, death. Many an automobilist, just for the thrill of racing with a train, and scaling across the track in front of a limited, has been left on the railroad right-of-way, bruised, mangled, dead, the only excuse was for a thrill.

The greatest step in personal safety was when man ceased to demand

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an eye for an eye and a tooth for a tooth, and began to look out for his brother's personal good.

When I was growing up, I worked on the Southern Railway, and the atmosphere was filled with expressions like this, "Railroads don't care for you except for the work they get out of you, and we don't care for them except for their pay envelope." But that day is past, and we are thinking about the personal good of each other, whether we are in the capacity of an official or a laboring man.

Organized safety has done more to bind employers and employees together in the bond of brotherhood than any movement in my day or your day. There is a friendly rivalry between executives and those who toil to play the safest one to another.

Farther down the line, in the same evolution, we began to take into consideration the general public. Everybody rides on trains nowadays, and the men who are running the trains and the officials who are watching the movements are playing safe, but the public is criminally careless, and something must be done outside of shops and offices for the great American public, if we are going to reduce accidents to a minimum in the United States.

From the very beginning, safe operation has been focused in the minds of those who run railroads. This safety movement is entirely humanitarian, and if it has developed a utilitarian side, that is only a good by-product of the movement.

Has there been safety in the realm of railroads? I answer yes, but it must be practiced here as elsewhere. The N. C. & St. L. Railway runs through my town, and it has never killed a passenger in the history of the road, while under private management. The N. & W. has reduced its accidents one-third in the last few years; and the C. & O. has made an enviable record along this same line. Mr. Fuller tells me that the Seaboard Air Line has got its accidents down to almost one a month. Other roads up here in the North and the West that I am not personally familiar with would make us as good or perhaps better records. But when Safety is practiced constantly and continuously, then our accidents that are preventable are going to be reduced to a minimum.

THE PSYCHOLOGY OF SAFETY

The philosophy, then, of safety, is thought; the psychology of safety is reminder; and we can make a tremendous pull in the interest of safety when we remind those who are in danger of their love for life, because everybody wants to live and provide for his own and protect his own. The first articulate prayer of a child, as it kneels at its mother's knee, where the wifely and motherly love clamor for supremacy, is in behalf of your safety, as the child says, "God take care of papa."

How can we begin to interest men in personal safety, which, after all, it has been well said, is the best, surest and safest advice that has ever been given, our problem will have been solved.

While I am speaking here in this historic State House, where so many good laws have been enacted in the interest of Safety, let me remind you

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that unless we can create public sentiment on the outside, that the ideals of these laws can never be realized in Massachusetts, or in any other state in this union. These safety signs and safety boards and safety signals that are covering New England today are silent and eloquent reminders of care and caution, that involuntarily impress the mind and unconsciously order the eye and the hand and the foot.

But man's greatest jeopardy is at the grade crossing. Here is where the automobile and the locomotive come together. I never see a fellow hanging around a railroad or "beating it" down the track when a train is due but what I point my finger at him and say "There goes Sin on two legs," and as the wages of sin is death, if he reaps it, no one is to blame but himself.

Over in Georgia we have an engineer that ran over a fellow like that and they indicted him for manslaughter. I thought they ought to have a coroner's jury instead of a grand jury, and passed upon that fellow's dead body and said, "He came to his death as a dare-devil suicide," and let the engineer go on his next round.

It is at the grade crossing that the big Mogul engine and the Tin Lizzy meet. Of course, the engineer ought to stop and let the Tin Lizzy go by, but custom won't permit it.

In my county, there was a lady out driving with her mother and her little children and neighbor. They came to a crossing. The train comes out of a big, deep cut there, and just as they climbed the hill and went spinning down toward the railroad track, the lady applied her brakes, stopped her car and turned to the little girl and said, "Jump out, darling, and look both ways and see if there is a train coming." Before the door of the car was opened, a big engine pulling a fast passenger train shot out of the cut. The women in the rear of the car screamed and said, "Oh, how near we came to being killed!" But the cool, calculating woman driver smiled and said, "We are in no danger at all. I always stop my car at a grade crossing." If every automobilist would do that, there would never be another accident at a grade crossing in our country.

CHAIRMAN CARROW: Mr. Holcomb, we are deeply grateful for this fine address. The next speaker is Mr. C. W. Galloway.

THE IMPORTANCE OF SAFETY IN RAILROAD OPERATION

C. W. GALLOWAY, VICE-PRESIDENT IN CHARGE OF OPERATION AND MAINTENANCE, BALTIMORE AND OHIO RAILROAD, BALTIMORE

There are today few lines of industry, if, indeed, there are any, which have not been convinced that safety work among employees is indispensable. There is no disputing the fact that it is a real, live energetic force in the accomplishment of success in industry.

Despite the knowledge that safety endeavor is as indispensable in a plant employing large groups of men as are tools, or machinery, in the critical months just passed there were, unhappily, some industries which

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exposed their man-power to its old habits by a pause in safety endeavor. When it was found necessary to curtail expenditures, some supervising officers began with the safety department. With the slogan of "economy" or "retrenchment" came the demand for greater efficiency. Yet the basis of efficiency—namely, safety—was undermined by some industrial leaders. I believe the Steam Railroad Section of the National Safety Council can justly be proud of the fact that its efficiency has been so well established that its work will not be hampered by such practices.

There was a day when construction specialists, in planning a factory, a railroad, or any other place where men and machinery would come in contact, gave as little consideration to the *safe* placing of machinery, tool rooms, cranes, trackage, etc., as they did to fly-screening. Happily, that day has passed. Now engineers consider *all* construction from the standpoint of *safe* operation. Even before the human element enters a plant, science has done its part to make conditions safe and sanitary.

This came about, primarily, because of economic necessity, and also because of the indefatigable plans carried out by you men directing the fight against carelessness. There were employers keen enough to see that the monetary losses from unsafe conditions and practices were unnecessary and were becoming a serious and continuous drain upon the treasury.

WORK OF SECTION SAVES THOUSANDS OF LIVES

It was only a step from the economic to the humanitarian aspect and I feel certain it was the latter which gave birth to the National Safety Council. The magnificent and magnanimous efforts of this body, directed towards the preservation of human life and happiness, is one of the bright spots in the history of safety in the United States. There are men within the sound of my voice whose inspiration and efforts have saved the lives of thousands of our best transportation workers.

The world applauds generously whenever a grateful nation presents to some conspicuous military or political leader a cross of honor for his gallantry in armed combat or in subtle conflict of words and ideas. The extent of their victory in combat is measured by the number and helplessness of their victims. Yet leaders in safety work go on, year in and year out, with no praise of victory sung in their honor; with no material rewards other than their stipulated salaries, and, at times with only scorn from those they have actually saved from the grave or from life-long suffering.

An ungrateful world may have passed you safety men by—I see none of you wearing, at least conspicuously, any golden or bejeweled insignia of honor conferred by civil authority. But you have in your breast the feeling of elation that comes to those who have done a good work well. You have the gratitude and encouragement of your superior officers. That, after all, surpasses in value the world's plaudits, for you all know the fickleness of public approval.

To me it is an inspiration to be permitted to appear before such a sturdy, courageous, intelligent group of men as you, gathered here to help humanity in its struggle towards happiness. The world often sneers at and

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belittles your efforts; the very men you strive to preserve in health and contentment sometimes in caustic words try to belittle your accomplishments. But the undaunted manner in which your work has been carried on makes the Steam Railroad Section of the National Safety Council deserving of unending praise.

HELPING TO SAVE CARELESS RAILROAD EMPLOYEES

I have watched the progress of the safety work on the Baltimore and Ohio particularly, for many years. I have seen some of my friends become careless and lose their lives and some permanently or temporarily crippled. Reports of casualties come to my desk at times and cause me to find tears in my eyes, bedimming the words written upon the report. Men whom I have talked to only a short time previously are reported dead or with arms or legs missing. I realize then that safety has a personal contact. I realize, too, that if I am any sort of a man at all, I must help save from death and injury some of the best railroad men, who are careless of their lives and limbs. This has made me throw my full support to accident prevention work.

Many of us read with impunity casualties reported in the daily press, or from railroad reports, until the day comes when an intimate acquaintance, a friend, perhaps a relative is the victim. Then we begin to THINK. Then we turn over in our minds the fact that something ought to be done to prevent the recurrence of this accident; to stop ALL accidents. That's bordering on selfishness, as regards the rest of mankind, I'll admit. But we are aroused.

WHAT THE BALTIMORE AND OHIO HAS DONE IN SAFETY

It is with no little pride that I point to some of the accomplishments for safety on the Baltimore and Ohio in recent years.

In 1915 the casualties among employees totaled	9,659
In 1920 the casualties among employees totaled	6,941
Or a decrease in casualties of	28%

Let us turn now to the amount of business that we handled in these two years, for the greater the business, the greater the number of trains moving and the greater is the liability of accidents.

In 1915 the gross ton mileage was	32,335,710 000
In 1920 the gross ton mileage was	40,867,502,000
Or an increase of	26%

Analyzing this a little, we can see that

in 1915 the gross ton miles per casualty were	3,347,728
In 1920 the gross ton miles per casualty were	5,887,841
Or an increase of gross ton miles per casualty	76%

From another angle the comparison is interesting:

In 1915 the freight train miles were	18 680,091
In 1915 the passenger train miles were	16,650,136
Or a total train mileage of	35,330,227

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In 1920 the freight train miles were.....23,627,077
In 1920 the passenger train miles were.....16,390,788

Or a total train mileage of 40,017,865

That means that in 1920, compared with 1915, the increase in train mileage, both freight and passenger, was.....13%
And at the same time our casualties *decreased*.....28%

RESULTS OF SPRING DRIVE AT FOURTEEN POINTS

We reached the pinnacle on the Baltimore and Ohio last spring, when we conducted a special test of sixty days' duration, during April and May. Fourteen of our most important terminals were chosen for the test. Foremen and other supervising officers were held responsible for any avoidable accidents occurring among men under their jurisdiction.

The final results showed that the winning terminal on the Eastern Lines, East Side Shops and Yards at Philadelphia, worked 1,558 per cent more man-hours per casualty this year than during the 60 days in the same months last year. The winning terminal on the Western Lines, Toledo, had a gain of 1,214 per cent in man hours per casualty. Total casualties were reduced, as follows:

Eastern Lines .....82 per cent
Western Lines .....79 per cent
System .....81 per cent

This is a gratifying record. It could have been achieved only after a long period of intensive safety effort, such as we have had in the last ten years. It also proved the contention that the interest and co-operation of all officials from the president down is essential for success in safety work. Our president has placed "safety above everything else". And rightly so. Any laxity on the part of a supervising officer will be detrimental to a good safety organization.

I would urge upon those in supervising positions to give due consideration to the safety work, even in the days when the most economical handling of railroad work is required by the exigencies of the times. What is the advantage of curtailing expenditures in one direction and increasing them through claims. If we must turn off the spigot, let's make sure the bunghole is tight. It was necessary, of course, for our railroad, like all others, to curtail expenditures last spring in every direction we could, and we are still curtailing. I am certain, however, safety work on the Baltimore and Ohio did not suffer, nor was the work even hampered.

ACTIVITIES OF SAFETY COMMITTEES

Our safety committeemen are still as active as they were a year ago. In the year 1920, our safety committeemen numbered 1,587. Every one of these men was continuously seeking out bad practices and conditions. They made reports of 13,824 unsafe conditions and practices and 12,034 of them, or 87 per cent, were corrected. There were 9 per cent of the total

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number pending and carried over to 1921. Only 4 per cent were dropped for one reason or another.

This is a great army of trained men working to eliminate dangerous conditions and unsafe practices of themselves and their fellow employees and the results obtained are well worth the efforts they expended.

There is a phase of safety work to which I want to invite your special interest. That is the prevention of accidents at railroad crossings. I refer to this here in the hope that something may be done in a united effort to halt the growing number of deaths and injuries from this cause. With each recurring year the increase in the number of automobiles and the growing carelessness of the drivers make it of the utmost importance that we devote extraordinary effort to lessen accidents at grade crossings.

There were 4,350 persons killed in automobiles at grade crossings in the United States from January 1, 1917, to December 31, 1920, and in the same period there were 12,750 other persons injured.

NUMBER OF AUTOMOBILES IN USE IN THE UNITED STATES

In considering grade crossing accidents, we are confronted with the fact that there is yearly an increasing number of automobiles being used. It is estimated that there are ten million motor vehicles now in use in the United States. One factory which makes a low-priced car is turning out around 4,500 machines daily and has orders far ahead. Practically all manufacturers of motor driven vehicles are working near maximum production, and this means an increase in the number of motor driven vehicles which will use our railroad crossings. We must adopt the most effective measures to eliminate accidents at grade crossings so that the increase will not keep pace with the growth in the number of machines being driven.

GRADE CROSSING CAMPAIGN NEEDED

It was with alarm that I read the reports of grade crossing accidents showing increases month after month in 1919. In November of that year I determined to take decisive steps to apply a remedy. I felt that if the drivers of cars could be reached intimately they would heed the warnings which we had determined upon.

We started the campaign by placing observers at a few crossings where travel was heavy. They were provided with a card on which could be shown the date, time of observation, and other data. When the observer noticed the driver of an automobile approach the crossing and dash over it without taking any precautionary measures whatever to assure himself that there was no train coming in either direction, the license number of the machine was recorded on a card. These cards were forwarded to my office where they were indexed in our record and then distributed among the automobile commissioners according to the state which issued the licenses. The commissioners, after referring to their records, forwarded the cards to the owners of the machines in the stamped envelopes we provided.

These cards, after reciting the facts of the observation, and stating the time and location, contain a warning to the drivers or owners of auto-

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mobiles that their lives and property had been risked unnecessarily, and that a repetition might bring disaster. In the great majority of cases, the recipient of the card realized that he had been careless and a great many wrote us and expressed their appreciation of our efforts to save them from injury, and commended the plan.

That this method of direct dealing with the careless or thoughtless automobilists was effective is manifested by the gradually declining percentage of failures to take precautions. When we inaugurated the observation plan on the Baltimore and Ohio, we restricted it to a few crossings on our Eastern Lines, and we found that 84 per cent of automobiles failed to take proper precautions when crossing our tracks. This spurred us to greater activities. In the three months of

November, December 1919; January 1920, we made	1,933
observations and there was a total of	484
failures to take safety precautions, or	25%

That meant that one driver in every four was not safeguarding his life, despite the fact that there was some kind of protecting device at all the crossings checked by our observers.

RESULTS OF CAMPAIGN

During the year 1920, we extended our observations. In the

12 months of that year, there were	49,665
observations, with	8,236
failures, or	16%

In 1921, our observers became even more active and in the first

Six months of this year, there were	248,988
observations made, and the failures reached only	8,775
or	3½%

Please do not be deceived by these figures for our system in the first half of this year. There are still places where automobile drivers have not been impressed with the necessity of taking care of their lives, limbs and property. In the six months, on one division, for example, 112 machines were observed crossing our tracks and not one of them stopped, or even hesitated, to see if a train was approaching. There was another division with 89 per cent of failures out of a total of 754 checked by the observers.

METHOD OF DISTRIBUTING WARNING LEAFLETS

The results of our observation tests caused us to go a step further. We had printed more than 4,000,000 warning leaflets, showing on one side a boy warning an automobilist to stop before he crossed a track on which a train is seen approaching. On the reverse side is an actual photograph of a machine reduced to splinters when struck by a train at a crossing, and killing both occupants. We arranged with casualty insurance companies, big mail order houses, wholesale dealers of all kinds, automobile supply houses and many other branches of business to send out the leaflets in their mail. It was found that every business house we appealed to

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gladly consented to co-operate in the campaign and these millions of leaflets went all over the country, and, I feel sure, did a great amount of good. I am sure some of you gentlemen received at least one of them. I trust none of you received an observation card.

The automobile commissioners of the different states through which the Baltimore and Ohio run also co-operated with us and sent several hundreds of thousands of the leaflets out with the license tags.

Next we posted at gas filling stations, garages, automobile club rooms, accessory dealers' shops, tire shops and other places where automobilists are accustomed to gather a larger poster in colors showing the boy halting the automobile. It was not long before 10,000 of these were in view of automobile drivers to convey the lesson of safety.

There was one other means to reach the owner and driver of the automobile. That was through newspaper publicity. One story telling of the dangers careless automobilists expose themselves to was sent out and reached 2,600,000 readers. In many instances the newspapers took up the matter editorially and commended the Baltimore and Ohio for bringing the facts to light.

One especially vigorous editorial appeared in the Hearst papers in the west, the *San Francisco Examiner* and the *Chicago Herald-Examiner*. The editor commented thus:

> "There is never going to be any guarantee of the safety of human life that is not based upon the human factor. It is well enough to invent safety devices, but the best safety device in the world is intelligence. No amount of signs, notices, semaphores, red lanterns, machinery, or policemen can save an absent-minded man, who will not look where he is going, from breaking his neck. Safety, in other words, along with many other things we think we can get by cleverness, can only be gotten through education. There is no short cut."

That's the truth in a nutshell. We found there was no "short cut", and while it took us a long time to "go round", we have arrived almost at the goal we have been aiming at.

With genuine and sympathetic co-operation by all the railroads in some definite plan of campaign, the accidents at grade crossings in this country can be cut to less than one per cent of the machines using the crossings, and in spite of the rapidly increasing number of motor vehicles in use. Just figure out what that will mean in saving human life as well as the saving to the railroads in claims for personal injuries and property damages for a single year. It can be done. Let's do it!

FAILURE OF APPLIANCES NOT CONSIDERED

A stage comedian once remarked that "Familiarity breeds attempt." He might have applied that to the large number of drivers of motor vehicles who become so familiar with the appliances provided for their safety at grade crossings that they absolutely ignore them and attempt to cross the tracks without first stopping, looking and listening. We have dis-

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covered that crossing gates, regarded as one of the best preventives of accidents, do not eliminate them. Eight times last year, they were run through and damaged in one suburb of Baltimore alone where a state highway crosses our tracks.

It sometimes happens that the automobile driver places his life in the hands of the gate tender absolutely. The gateman, being human, sometimes errs, and the driver is a victim. Electric warning bells ring so often on the approach of trains that automobilists soon fail to heed the sound of the big gong. They fail to consider at all that these bells are operated by a power which sometimes fails, even at the moment of the gravest danger.

Crossing watchmen are not infallible. While automobilists and drivers of other vehicles, even pedestrians, are encouraged to look upon the protection afforded by watchmen as security against accidents, the full benefit of their services cannot be obtained without the fullest co-operation of those using the crossings.

We have had several distressing automobile accidents on the Baltimore and Ohio in recent years that indicate the necessity of gaining the sympathetic co-operation of owners and drivers of machines if we are to have any degree of success in cutting down the casualties. Here are a few specific cases to which I will refer:

SPECIFIC CASES OF CROSSING ACCIDENTS

On July 30th, 1916, at Monroeville, Ohio, on our Newark Division, a passenger train running at a speed of thirty miles per hour struck an automobile on Sandusky Street crossing, derailing and turning over engine, derailing tank of engine, baggage car and two coaches, damaging equipment to the extent of $1,855.00. The engineer and fireman were fatally injured, and three passengers were injured. The accident was due to the automobile being stopped on the crossing when the driver attempted to cross ahead of the train.

On January 27th, 1916, at Pataskala, Ohio, on our Newark Division, a passenger train struck an automobile on Broadway Street Crossing, derailing engine and six cars (four mail cars, one combination car and one coach), fatally injuring the driver of the automobile, slightly injuring ten postal clerks, eleven passengers and the conductor. The damage to railroad property was $6,826.00. The accident was due to the driver disregarding the audible signal, sounded by electric alarm bell, and attempting to cross over ahead of the train. In some manner, the machine missed the crossing which is standard width and was on the track beyond the crossing when struck by the train.

On July 21st, 1918, at The Bend, on the Chicago Division, a passenger train running at a speed of 48 miles per hour, struck an automobile on road crossing, resulting in three persons being killed. The engine bell was ringing and the whistle was sounded as the train approached the crossing. Crossing is protected by sign. The accident was due to the automobile being driven on the crossing directly in front of the train.

On March 7th, 1920, at Bremen, Ind., Chicago Division, an automobile-

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bus, occupied by the driver and seven passengers, was struck on road crossing, resulting in six persons being killed. The crossing is protected by electric bell which was operating. Engine whistle was sounded and bell ringing. There was a good view approaching three hundred feet from track up to about one hundred feet.

Recently I had a very exhaustive check made of the crossing accidents on the Baltimore and Ohio and I am going to give you some data which I believe will surprise you. I took as a basis a continuous series of 138 accidents in which there were personal injuries. In these accidents there were from one to ten persons occupying the machines involved. You will understand how careless are some persons when other lives than their own are entrusted to them.

ANALYSIS OF 138 ACCIDENTS TO AUTOMOBILES

In these 138 accidents there were
68 persons killed
160 other persons injured

Were I to ask the average railroad man what day in the week he believed the greater number of accidents happen, he would say Sunday. The 138 accidents happened on the following days of the week:

Sunday	15	Wednesday	27	Friday	19
Monday	25	Thursday	17	Saturday	20
Tuesday	15				

It would seem to indicate that the automobile truck is more likely to accident at crossings than the pleasure car, for there are more of them in use on week-days than on Sundays.

CONDITION OF THE WEATHER

Another surprising fact that the check brought out was that nearly all the accidents happened while the weather was clear. This seems to indicate that persons take more chances in clear weather than when it is raining or snowing. Our check showed:

Accidents in clear weather	122
Accidents in cloudy weather	7
Accidents during rain	7
Accidents during fog	1
Accidents during snowstorm	1

Many times it has been felt that accidents were due to the fact that drivers were closed in by curtains, or pedestrians had umbrellas up, obscuring their vision. It appears from our check that the chance taker finds clear weather the best time to operate.

ANALYSIS AS REGARDS THE VISION OF DRIVER

We likewise considered the facts bearing on the vision the driver had of the approaching trains, whether there were buildings, trees, curves,

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embankments, cars, signs, or weeds that would prevent an unobstructed view of approaching train. Our check showed the following:

Accidents where the vision was clear	113
Accidents where the vision was partially obstructed	25

This gives a preponderance of "clear vision" accidents and indicates that the injunction on the warning sign to "Look" before crossing the track, is not put there merely to fill up space, but as an aid to the "stopping" and "listening."

Next we considered the kind of protection afforded the driver who must pass over our tracks. The following are the facts regarding the 138 accidents which we analyzed:

KIND OF PROTECTION AT CROSSINGS

Accidents where there was a standard sign only	72
Accidents where there were watchmen	20
Accidents where there were automatic bells	19
Accidents where there were gates	8

There were 19 other accidents where there was no kind of a warning device—that is—they occurred at privately owned crossings.

The question of automobile accidents at grade crossings is, I consider the most important one the railroads have to deal with, and I cannot too strongly impress upon this body of safety men the necessity of inaugurating a vigorous educational campaign against accidents of this character, both for humane and economic reasons.

As I said to you before, I consider that the most important thing that confronts us today. I trust you will take that matter up, and I believe if you will analyze it on the basis that we have analyzed it, you will find there is a wide field, and if you once get started, it will surprise you how people will observe your warning.

For instance, we have had letters of criticism in some cases and letters of commendation—mostly commendation—but the important thing of all that we have developed by this campaign is that in a number of cases we have shown to the owner of the car, that the car was out without his authority. I have had men say, where we have reported a truck, "The machine was not out on Sunday." We have proved to the man that his driver had the machine out with a lot of people.

On one occasion, a young girl driving a truck lost control of the machine on the approach of a light engine and started up the track, with the result that the engine hit the machine, demolished it, killed one person and hurt ten or twelve others. The owner said the truck was in the garage but he later found it was not.

Furthermore, we have found a number of cases of the unlawful use tags. These cards pass through the commissioner's office with an addressed envelope. He has found people with machines that had no right to have the tag on the machine. We have, with this activity, started the automobile drivers to thinking in the various states in which the Baltimore and Ohio operates

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Now I am not clear what the plans are regarding the future of this Council, but my own opinion is that the best results are going to be obtained by preserving the integrity of the National Safety Council. I would urge, Mr. Chairman, that efforts be made to preserve the integrity of it because of the importance of your work.

Your work is of great importance with relation to the public. You have got the railroad man pretty nearly right. You have accomplished a marvelous work in getting the men on the railroads with whom you are associated, to observe these things. What I say here about the Baltimore and Ohio is applicable to others. You are getting the co-operation of the railroad workers. You are getting it not only on our road, but I observe it on the others on which I occasionally travel. The feeling is generally good towards this. The Brotherhood leaders are with you. I know they are interested in this because I get information from them about their interest in the direction of safety work.

Now, having gotten that so well organized, having gotten such a thorough interest on the part of those men in your work, I want, at the risk of repetition, to again bring to your mind the importance of these grade crossing accidents. You can't eliminate all of them. It is a stupendous task. It is not fair to put all of the burden on the railroad, but in every case a jury does, so you have got to take the next horn of the dilemma and that is to educate the driver, not by arresting him but by demanding a higher grade of intelligence, that when a man is careless he receive proper treatment at the hands of those issuing licenses by having his license revoked. I have had a number of licenses revoked, not only for railroad crossing cases but for other cases. If you pursue that and get the practice started, you will be surprised at the results you will get in a better observation of safety principles.

I firmly believe that if the Baltimore and Ohio had not pursued this plan, particularly on some of our divisions where the state highways run, we would have had a great many more accidents. But it speaks for itself when we have made nearly two hundred and fifty thousand observations in six months, and only three and one-half of what we term failures, and these were in every case made by the same set of men.

It may interest you to know in connection with grade crossing accidents that a check of the records of 50 engineers promoted to passenger service, discloses that from the time these men were hired as firemen in freight service, until they reached the time when they were promoted to extra passenger engineers, averaged 17 years. A number of them were as much as 19 years. Notwithstanding the fact that a locomotive travels on rails which guide it, governed by signals which, figuratively, speak to the engineer, telling him what to do, whether or not to proceed at full speed, to slow or stop, besides various markers indicating speed limits and other conditions, and, added to this the instructions which he receives from train dispatchers, and yet, a man does not reach the position to operate a passenger locomotive until he has served nearly 20 years. At the same time, an automobile, which can run just as fast as the average passenger train, is placed in the hands of an operator after a few minutes' instruction and demonstration.

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I want to say, in closing, that I hope you will continue your interest in the gospel of safety.

CHAIRMAN CARROW: I must say that is without any doubt one of the most encouraging talks that we have ever listened to.

The Baltimore and Ohio has made one of the largest contributions to any meeting that we have ever had, and we thank you, Mr. Galloway, from the bottom of our hearts.

MR. SCOTT: Mr. Chairman and Gentlemen: A few weeks ago I received a request from an officer of the National Safety Council to state in a few words my reason for coming to the Boston Congress. My reply was that I was coming to Boston to receive information and inspiration necessary to carry on my work for another year, and that up to that time I knew of no place to which I could go to receive these things other than the annual convention of the National Safety Council, and I am very pleased to see. in the first sentence of an editorial in the October issue of the *National Safety News* these words, "The safety movement is a locomotive running on two rails—inspiration and information."

I want to say that as I go back from this convention, I have received sufficient information and sufficient inspiration to justify me and to enable me to carry on the work for another year, if I hear no more commitee reports and no more addresses of any sort. In other words, my battery is fully charged. I am going back to my system to carry on the work with renewed vigor, and I am hoping for success.

MR. HARTENSTEIN: Mr. Chairman, I want to suggest that this section of the National Safety Council extend a vote of thanks to Mr. Galloway for his excellent remarks.

The motion was seconded and carried by a rising vote.

ADJOURNMENT.

TUESDAY AFTERNOON SESSION

CHAIRMAN CARROW: The afternoon meeting will come to order.

We will ask the Chairman of the Committee on Resolutions to read the telegram prepared for Mr. Richards.

MR. SCOTT: Mr. Chairman, as the self-appointed stenographer of this Resolutions Committee, I would like to have you all listen to this telegram: "The Steam Railroad Section of the National Safety Council, in convention assembled, extend to you in this hour of bereavement an expression of our sorrow and sympathy." It is signed by the Committee.

CHAIRMAN CARROW: I have no doubt but that this telegram meets with the hearty approval of the representatives here present, and I know that you will be carrying out their wishes if you have it transmitted, Mr. Scott.

MR. WRIGHT (Omaha): I move that this body stand in silent prayer for two minutes.

The members assembled stood in silent prayer for two minutes.

Chairman Carrow introduced Mr. E. L. Bair.

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UPON WHOM DOES THE BURDEN FALL WHEN DEATH OR DISABILITY REMOVES A PRODUCER FROM OUR MIDST?

E. L. Bair, Vice-President, Benefit Association of Railway Employees, Chicago,

The subject of my address is, "On whom does the burden fall when death or disability removes a producer from our midst?"

Naturally, we all know that when a husband and father is taken away, the brunt of the burden first falls on the family, the loved ones, the old mother, or the loving wife and the little kiddies. The railroad company sustains a financial loss if killed on duty, when they pay out in settlement the money allowed by claim adjustment. But no amount of money can recompense a good wife for the loss of her husband, and no amount of money can repay a little child for the loss of its daddy. So the burden primarily is borne by the family.

Then next, the burden is borne by the Brotherhood. This man may get five or ten thousand dollars for the loss of a hand or foot, or an injury to his spine that makes him sit in a wheelchair the rest of his life. He is not accustomed to handling money in large amounts, and makes a bad investment, then it gets away from him and the Brotherhoods bear the load. I have passed subscription after subscription, and now in Chicago there is a great Brotherhood Home to take care of helpless railroad men. The Brotherhood is carrying the load and looking out for the family and the children. We carry the load. It is our business to spread the propaganda of safety. From a cold-blooded business standpoint, it pays. From a Christian standpoint, it pays. From a Brotherhood standpoint, it pays.

Men will come into a Brotherhood—joint the Order of Railway Conductors, or the Machinists, or Boilermakers, or Engineers, or Masons, or Knights of Columbus, or any other Brotherhood; and a fellow will put his arm around me and call me brother and shake my hand, and be nice to me, and then through the persistent indulgence in a careless practice will cost me my life or limb or sight! I think less of him than I would of a man who took my job, out on strike. I can guard against a scab, but not against the fellow who pats me on the back and then kills me because he doesn't do his work right.

We learn by experience. We learn by contact and we progress. We didn't always have safety first. I remember I was a brakeman when we first commenced to put on air, and we thought we could make good stops with the old Armstrong and didn't need air—we resented Westinghouse Air Brakes. Everything new that came on people resented. It was the same thing with Safety First. But it is a proven proposition now, and our men are waking up to the realization of what it is.

I am now conducting safety meetings without expense to this body or any railroad company, and the men are handling it on eighty-six railroads. It has even shown in organizations outside of the railroads.

Am I my brother's keeper? One of Christ's disciples, in trying to evade

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responsibility, said, "Am I my brother's keeper?" And the answer is always has been and always will be, "Yes, you are your brother's keeper." As this splendid man from the south said this morning, you get out of the world what you put into it. The message you send out, heartfelt, and genuine and sincere, to humanity, comes back to you. It is a wonderful world to live in, it is a wonderful age, and we are doing wonderful things, and I am glad that I am a poor man, a brakeman, a switchman, a conductor—one of the little fellows in the rank and file—who has been privileged to help to do something for those who need the help of thinking minds in railroad service.

What does this badge mean, or any of these badges that we bedeck ourselves with? Do we live our creed? You wouldn't hurt your brother or any dear one—but there are sins of omission as well as sins of commission.

I believe that this convention with the sentiment that I have heard here marks an epoch in this movement that you will date back to and say "Beginning at the Boston convention such and such a thing transpired." We are on historic ground. Right out here on Boston Common things happened that made this nation great. We are standing on sacred soil and it is meet that we should be here doing the work of the Master, doing the work of the Brotherhood, doing the work of a man.

In conclusion I want to say this: Some of us pray when we are in trouble, some of us pray every day, some of us only pray when we go to a lodge and repeat with a sort of trembly feeling the Lord's prayer, that is used in lodges. But I just want to say to you, that there never was any greater lesson in co-operative mutual benefit given to humanity than in that wonderful prayer from our Savior, and I don't care whether you are Jew, Gentile, Catholic or Protestant, when you pray that prayer and pray it as a safety man, and eliminate the "I" and use the plural, you say "Our Father", instead of "My Father"—"who art in heaven." You say "Give *us* this day our daily bread, and lead us not into temptation"—mutual co-operation—"deliver us from evil." It is the most wonderful lesson we have ever had, given us in that wonderful prayer.

Say it over, folks, think what it means, and how amicable it is to Safety, Brotherhood, Humanity and everything that is worth living for.

CHAIRMAN CARROW: We will now listen to a gentleman whose experience on the Union Pacific Railroad has been very gratifying indeed.

I will now introduce Mr. Harry A. Adams.

POSITION, AUTHORITY AND RESPONSIBILITY OF THE SAFETY OFFICER

HARRY A. ADAMS, ASSISTANT TO GENERAL MANAGER, UNION PACIFIC RAILROAD, OMAHA, NEB.

The position of the officer in charge of safety upon different railroads varies about as much as the colors in Jacob's celebrated coat, in many instances. In fact, it is questionable if the party assigned to take care of his work actually knows what his position really is, or what it means

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and his work is handicappd accordingly. This is one of the greatest mistakes which has been made. It is imperative, in fact absolutely essential that the officer in charge of safety work have the authority of a general officer. His position should be such as assistant to the general manager or other general officer, enabling him to conduct his business entirely over his own name and not requiring the use of any other name to have his instructions obeyed. In such a position and vested with such authority the safety officer is then enabled to obtain the co-operation of officials ranking below the general manager and better enabled to assure employees that their work in the interests of the movement will receive proper consideration.

Assuming that the safety officer is fortunate enough to find himself in this position, we can then deal with his responsibilities. These we all know are numerous and weighty. The first and one of the most important, is to perfect an organization that will produce results, proper organization being the keystone of success. This, of course, will vary upon different lines, but it must be ample to thoroughly cover the ground. One or two men cannot handle safety as it should be handled on several thousands of miles of busy railroad. There is no argument upon this feature, in my opinion. They cannot get around fast enough to keep in touch either with conditions or employees. They may be heard from, that is true, but proper safety work requires more than the issuing of numerous circulars, bulletins, or other such publicity work. The scope of the work is too great to permit of its being covered in any such manner. Tell me, if you can, how such work will find out if men are wearing goggles, properly flagging, using poor or defective tools, or taking other chances too numerous to enumerate, or if your physical or working conditions are as they should be. Issuing circulars will not make men properly place blue flags, or result in their being observed. Gentlemen, it cannot be done in that manner, one man cannot be in twenty places on a five thousand mile railroad at the same time. What is the answer? He must have competent assistants, and one of the most important of his responsibilities is the selection of such assistants. They must be carefully selected, from the ranks preferably, be men of good character, intelligence and thoroughly experienced in their line of work, so they can handle any matters put up to them, and as many different branches of the service should be represented in the organization as its size will permit. By this I mean it should not consist of say,—all trainmen or all shopmen. For example, in my organization I have a yardmaster, engineer, station agent, district foreman, attorney, conductor, machinist, with a man who has worked in several branches of the service in charge of the office. Such an organization leaves me free to devote my entire time to the work without being tied down with the smaller details, enables me to investigate personally all important accidents that may occur, attend all division safety meetings, of which I may say I have six each month as well as many of the monthly local meetings (thirty-nine in number) and in this manner keep in close touch. not only with all officials, but with the rank and file, and lend them assistance and encouragement in the work.

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HANDLING SAFETY SUGGESTIONS OF EMPLOYEES

No accident, however slight it may be, where there is carelessness or a wrong condition, should be allowed to pass without a thorough investigation. If caused by carelessness, the employee concerned should be shown the error of his ways; if through a bad condition, it should be corrected. It is one of the responsibilities of the officer in charge, to see that his subordinates properly take care of such work, as the proper education of employees concerned in minor injuries most assuredly will prevent more serious ones from occurring. He must know that suggestions made by employees receive proper attention and consideration. Nothing is more discouraging to an employee who makes a suggestion, no matter what its worth may be, than to have it passed upon in a slighting manner, as I have known many to be. Handle one in this manner and you have lost a good man to the safety cause; the fact that the suggestion was made proved that his intentions were good and encouragement will bring forth results. The man doing the work is usually in a position to see unsafe practices and conditions, and without his support or his calling attention to them, how will he get them corrected?

The formulating and issuance of proper statistics is also a responsibility, without them you are working in the dark, absolutely, and it is necessary they be published in a good plain manner in order that they will be understood. Talking of millions of gross ton miles or revenue passenger miles is beyond the actual comprehension of many; most men will understand what a locomotive mile means, or what a man hour means; therefore, care must be taken to compile statistics in some such plain way. We use the locomotive mile basis for train service casualties and the man hour basis for industrial casualties with good results; they both illustrate plainly the amount of the hazard.

The safety officer, different from most others, has nothing which will measure his accomplishments in dollars and cents. He has to obtain his gratification from the reduction in casualties against casualties, taking into account the volume of business and number of men employed and unless supported by his general officers, in times of reduction he is hard put to show what he has accomplished. The keeping of proper statistics will help him here, and it is his responsibility to see that he maintains a proper force at all times. Our work cannot be measured in dollars and cents; money cannot replace the head of a family cut off in the prime of life, replace lost eyesight or limbs, yet we know we are accomplishing such work and should place ourselves in a position where we can prove it and take our stand upon it.

ENFORCEMENT OF SAFETY RULES

Another great responsibility is to know that rules are being properly observed. Practically every rule contained in the various books of rules has safety embodied in it and it therefore devolves upon him to know, through his assistants and by his own personal observations, that such rules are being lived up to, not only by the employees, but even more so

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to know that infractions are not being condoned by minor officers, and where such infractions are found to see that immediate corrective action is taken.

The safe handling of explosives and other dangerous articles is one which requires constant attention. Employees must be instructed in the rules as laid down by the Bureau of Explosives and such rules must be enforced. This field alone is a large one, covering the handling of stations, proper location of cars in trains, handling of tank cars at loading and unloading stations, proper inspection of equipment and many other features too numerous to mention, all of which, however, are more or less directly concerned with his work.

The feature of discipline, while one in which he is not directly interested comes up in many different ways. Our aim is education of employees to observe rules and avoid the taking of chances, co-operation with us in this respect will naturally keep the employee out of trouble and away from the necessity of being disciplined. However, where we come across employees who deliberately continue careless practices thereby endangering not only themselves but others, and will not profit from our advice, then it becomes one of the safety officer's responsibilities to have them removed, either to some position where there is a remote possibility of their injuring themselves or others, or else from the service permanently. This feature requires judicious handling, not only so far as the welfare of the employee directly concerned is affected, but also of the many others who might also be jeopardized through his careless actions, and whom we must protect.

Safety work has been carried on for years, to a more or less extent, but only in recent years has its worth been really recognized, and it may still be considered only in its infancy. The problems of safety officers are daily becoming more numerous and their responsibilities correspondingly greater as the scope of their work is recognized and increased—recognized, not only by the management but I am very glad to say by practically all organizations of employees. It is essential that the safety officer not only have the whole-hearted support of every officer from the president down, but he must also have the good will and support of each and every employee.

The primary object of our work is the prevention of accidents and injuries,—what better object could there be? If properly carried out it is bound to result in higher morale and higher efficiency, thus being of great benefit not only to the railroad but to each and every employee. It is not a one-sided proposition; we all know that the saving of life and limb and the conservation of man power is a tangible asset to the railroad company and the nation as a whole, but it is without question, an even greater asset to the human being whose life, limb or eyesight may be saved through our efforts.

CHAIRMAN CARROW: Mr. F. H. Babcock, Safety Agent, Pittsburgh and Lake Erie Railroad, will now open the discussion.

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DISCUSSION

MR. F. H. BABCOCK: Mr. Adams has covered the subject well, and I believe he has left an impression with most of us who are engaged in safety work. I am highly in accord with the many points Mr. Adams brought out in his paper, but would feel somewhat remiss if I failed in the opportunity to express a thought that occurs to me.

The position of the safety officer should not be necessarily one of authority over others employed on the railroad, but essentially one of authority on safety matters, and a safety officer should be authoritative on the merits of safety measures. Then if the co-operation is real, it is only maintained by virtue of the importance of the measures to be taken, in effecting safety.

As to responsibility, the safety officer should be imbued with the full sense of his responsibility and his efforts will then, when intelligently marshalled, carry force—the force of their purpose—which is to prevent accidents and injuries. Force coming from a spirit imbued with such a purpose will be effectual.

CHAIRMAN CARROW: Mr. Bentley, I would like to hear from you.

MR. BENTLEY: Mr. Chairman, never having been clothed with that authority, I don't feel that I am an authority to speak on this subject to any great extent. I am rather inclined, though, to think that Mr. Babcock is right. I doubt, so far as my experience goes, if the safety officer should be clothed with the authority to arbitrarily order changes in conditions: certainly not until the time shall have arrived when that position shall be dignified to the same extent that other positions carrying that authority are dignified.

Personally, I do not crave that authority. From the stand point of the good that I have been able to do, if I have been able to do any good on the railroad that I represent I want to state that I feel that that good has all been done through appeals, through showing the men the errors of their ways. I also feel that because I have specialized along the lines of safety study, that I am qualified to tell the officer wherein I feel he has erred, even though he may be credited with a greater stipend than that which I receive.

In justice to the official personnel of the railroad that I have the honor to represent, I want to say that it was told me the other day that the officers of the Chesapeake and Ohio Railroad have confidence in the safety department of that company. If I can secure and keep the confidence of the officers within whose scope it is my duty to correct unsafe conditions, and to apply discipline when it may become necessary, I can conceive of no greater privilege that I can have than to go to those same officers and show them what I think should be done.

I don't brag of what the Chesapeake and Ohio has accomplished, but I have been mindful today, as different subjects have been discussed, and well discussed, that I am probably more fortunate than are some others of the safety representatives. I do not claim for myself or my organization the credit for the wonderful success that has followed the safety

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campaign on the property that I represent. I ascribe all of the honor and glory and credit of the success that has followed our efforts, to the privates in the ranks, the employee members of the committee, if you please.

I want to mention one little occurrence, if you might call it such, that has been of tremendous encouragement to me, and that is, that when all of the railroads of the country were cutting their payrolls, and were seeking out every possible wastage, that it might be cut off in order to keep their expenditures down; when the safety departments of other railroads were being wiped off by the wholesale, when meetings were being made bi-monthly instead of monthly, and when some of them were being disbanded altogether, I saw the need of a safety inspector in our mechanical department, and I dropped a quiet note to the general manager, the chairman of our general safety committee, asking him if he would not give me another safety inspector. The recommendation was passed to the president with his recommendation, and although the times were difficult, and money was scarce, my request was granted. The Chesappeake and Ohio did not stop for one minute their activity in safety work.

CHAIRMAN CARROW: I would like to hear from Mr. Meredith of the Central Railroad of New Jersey, briefly.

MR. MEREDITH: Even if I could, there is very little that I care to criticize. Your minds have been differing quite widely. You will never get a healthy safety organization until you get the subjects viewed and discussed from every angle. It is not a healthy situation to have a one-sided "amen chorus", as somebody happened to express it. That is one of the things I particularly appreciate, in noticing the divergent and yet convergent views of the speakers.

CHANCE TAKING CAUSE OF MOST ACCIDENTS

There is just one point that is going through my mind and has been all day. My experience with safety work is very limited, but limited as it is, this is a thing that impressed me most: The tendency of our committees has been, as some of the gentlemen pointed out, to speak of and call attention to the physical things which led to injuries. All that is necessary, proper and essential, we want. We want to know where they are and what they are, so we can correct them. But after all is said and done, it is not those little things they call attention to that lead to the greatest number of accidents. It is the inherent tendency of the man himself to take chances and not exercise good common sense in handling his own condition of safety of himself and the other employees.

I recall many years ago a very simple illustration. There was a farmer's boy brought up on a farm and among other things, the practice had grown in him of dropping the fork down so somebody would fall over it in the dark. Admonition went out that that fork must be stood up straight. For many years that same farmer's boy was under the same kind of training. Habitually he got into the way of putting things where

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they would be safe. He didn't have to think about it. He did it unconsciously, and that is the simple, almost pure, illustration that I want to bring to your attention, because it has so much of the meat of the real success in safety work. You must train your men to be careful; not to be careful in the way of stopping and thinking about a thing a while, but unconsciously, or sub-consciously, if you please, do those things which make for safety, and which avoid the possibility of danger of accidents.

I believe that in that line, in the training and education of the men, training them to do sub-consciously those things as they do it in their daily walks, will do more to save life and limb than any other one branch of the very wide field of work that we take.

I am speaking particularly to the physical angle of the situation. I don't want you to think that I am deaf to the humanitarian side also. None of us here wants to see any person killed or injured. Even the small injuries cause distress.

I want to revert again to that thought I tried to express and that is, that we must train the man, we must indeed do all other things, but first we must train the man to be safe and careful. The brakeman that walks down the tracks and kicks a stone out of the way so some other fellow wont' fall over it is doing more safety work than many other persons.

CHAIRMAN CARROW: Mr. Meredith is General Superintendent of the Central Railroad of New Jersey, which adds another star to the brilliant firmament that we have had around us today.

Mr. La Fountaine, I would like to hear from you also.

MR. LA FOUNTAINE: I think it has been pretty generally discussed, and I don't know that the title means a great deal. I think the man will generally get about as much authority on the railroad as he is deserving, and it has been my experience that while one might have the title of general safety agent and another general safety supervisor, it doesn't mean much as to just how much authority he has. I think if he has the ability to deliver the goods, he will be generally recognized by his officers, and if he hasn't all the authority, that he may need to put it over, he can get it.

MR. ADAMS: I might say a word. I am not unnecessarily proud of any title. It is the title that the president saw fit to put on the job, not the man, and it doesn't have anything to do with the question of authority. The thought was, with our general manager, that in placing a man in charge of one of the essential departments of the railroads today, clothe him with such authority that when he was investigating an accident, a wreck or anything else, that had to do with supervision on that line, that he was representing him, and consequently, would have the authority that was necessary to get the information that was required.

MR. BRENNAN: That is about all the authority, I believe, that the safety official would require. I don't think we are looking for local glory but results.

MR. WOLLNER: Mr. Chairman, I believe it is true in safety, as in every other activity, that all men who gain success do not gain it in the same way. There are as many ways of gaining success as there are ways of

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doing things. Some men gain their success in their work through the exercise of authority; others gain it through stimulation; others gain it through suggestion. All these methods are worthy, and it seems to me that the proper safety, or the proper man for a safety officer, as has just been stated, will take the amount of authority that he feels is necessary for him to have to do his job successfully.

CHAIRMAN CARROW: Mr. Ridgway, would you care to speak?

MR. RIDGWAY: The chairman of the safety committee is usually the shop foreman, general foreman, superintendent of shops or division superintendent. Undoubtedly, in any well-regulated safety organization, those chairman have the authority to correct dangerous conditions, and I doubt not that they do so without hesitation whenever there is attention called to them by members of the committee.

PROMPTNESS IN CORRECTING CONDITIONS ESSENTIAL

Now, the confidence that we give to the employees in this safety work is the promptness with which conditions are corrected. It may be different on your road than it is on mine. Things may move a little more slowly with you than they do with me, but if you take means of presenting to the committeemen all of the suggestions that they have made and be sure to single out the correct ones and those which are refused, if there are any—I assume there are very few—in that way the employees will gain confidence in the sincerity of the movement on the respective roads.

I don't believe I want any authority. The confidence of the people whom I serve is all that I can ask.

Another phase of the situation is just this: You know that a railroad to be anything has to be a good deal like the army—discipline must be discipline, orders must be obeyed, and organization is essential in every line. There are men on the railroad whose authority it is and whose duty it is to make all corrections in the physical property. I doubt very much whether any safety officer ought to order such things made. For myself I don't believe I want the authority.

MR. LONG: In the first place, I don't believe that authority is necessary for safety officers. Our work is largely an educational one. Our problem as I see it, is to get employees to eliminate or stop unsafe practices. The way to get men to do that is to make them want to do it, rather than to have to do it. I think it is good practice for a safety man to get the officers to want to do things instead of making them have to do it.

MR. MORRIS: I don't see wherein the authority of a safety agent over other men of authority would be essential. I do not crave that authority. All I crave is to do good, to help the rank and file. When I go to my general manager to report that such and such ought to be done, it is done. That is all the authority that is ever needed, and I would rather it came from the general manager than any other man on the railroad.

MR. BRODERICK: I simply wanted to supplement what Mr. Morris just said. So far as the Baltimore and Ohio Railroad is concerned, from my

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experience in this work, we don't need authority. At least, I don't need any authority, and I don't want it.

That is our position. The head of the safety department doesn't find it necessary or apparently desirable to have any authority in this work. The chief function of this department is to plan and suggest and we have been successful in that way by having our suggestions and our plans adopted by our people, and they are glad apparently to have somebody help them out in that particular work.

MR. ADAMS: I would like to have Mr. Bentley state to this assembly why he suggested this subject, and what he said in suggesting it in the letter.

MR. BENTLEY: My reason was to bring about exactly what has resulted, Mr. Adams—a discussion of this matter. I was sure that Mr. Adams, having been clothed with that authority, would be in position to speak from his experience as to the application on his particular railroad, and the results that have followed that authority.

MR. ADAMS: I think you will also pardon this expression, but you did say on account of the splendid work that had been done on the Union Pacific, you thought I was qualified to answer that question.

MR. BENTLEY: And I don't retract one word of it, but it does bear out what some of the other speakers said on the subject—that one man may follow one line of procedure to accomplish results; another man may find another method of procedure proper to suit his conditins, and his ideas of going about that particular work.

MR. MAYO: As far as the question of authority is concerned, with me I don't want any authority at all.

MORE AUTHORITY FOR SAFETY MEN NOT NEEDED

MR. WALSH: A well-organized safety department on a railroad does not need any great amount of authority, in my opinion. In the first place, to make it successful, it has to have the approbation and approval of the highest officer in the railroad. I think we have plenty of authority; we don't need any more.

MR. PHILLIPS: My work has been in the legal department of the railroad, and I wouldn't want the authority at all. In my case it would mean dictating to the chief engineer, the operating head of the transportation department, superintendent of motive power, and my training has not been such that I would feel at all competent to do that sort of thing.

MR. PRATT: I wouldn't want any more authority because more authority would put more responsibility. Give it to some one else, as has been suggested. If they don't see it clearly, and don't want to make that change, the safety man is out of it.

MR. ROWE: I believe, as Mr. Bentley expressed the thought, that you can get more by appealing to the hearts of your men than you can by direct force or discipline. I am for the appeal to the man every time.

MR. DOW: Mr. Carrow, as I recall Mr. Adams' paper, he refers specifically to authority over officers below the grade of general manager. I

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think that all the authority that I needed as safety agent was my appointment as general safety agent signed by the president. That didn't mean to me, as I looked at it, that I had the authority to order a superintendent or any other officer around. I consider the best authority that a safety agent can have is his own ability as a salesman, and that if he is not competent to sell the safety idea to the officers, he has no business to be on the job.

MR. PHILLIPS: If by authority you mean the power to say to this man, "Go", and he goes; and that man, "Stay", and he stays, I wouldn't want it. One reason is that I don't want the responsibility for the conduct of a division or the division superintendent. I want to make a safety man out of him, and make him feel that he is responsible for the safety operations on his division.

MR. ADAMS: It seems that it becomes necessary to impose upon your kind-heartedness to defend myself on this paper that Mr. Bentley got me to write, from the various gentlemen who do not want to be dignified with authority—of course they don't. They wouldn't take promotion if it was offered to them. I know they wouldn't; that is far from their thoughts. If their general manager happened to call them in and say, "I believe we can get better results by dignifying this office and appoint you as assistant to the president or general manager," then I believe that would be the right thing to do. If he believes that by doing that and clothing the department of safety with a title that will carry with it some prestige, that is his privilege. Some other railroad may want to call the officer in charge of safety the general chairman.

We don't care what you call your general safety officer. We don't discipline anybody in my department. I have not the authority to discipline anybody; never have had. I believe we have reduced accidents on the Union Pacific from 50.4, January 1, 1921, to 7.44 per million locomotive miles. I think that testifies as to whether or not our department is functioning harmoniously.

CHAIRMAN CARROW: Gentlemen, I think this has been a very illuminating day. I think we are *all* right. There are situations that develop on railroads that create positions. For example, a general manager might have a very efficient man, and need somebody to take care of safety. The road might not be big enough to warrant the appointment of this man exclusively to handle safety. He could very properly handle two jobs. My friend Hartenstein does it. He is assistant to the general manager of the Lehigh Valley and is also safety manager.

ADJOURNMENT.

WEDNESDAY MORNING SESSION

CHAIRMAN CARROW: The meeting will come to order. Accident Bulletin 74 was the first put out in connection with the revised system of accident statistics by the Interstate Commerce Commission.

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It is an approach to a scientific analysis of the causes and results of accidents, and the chairman of the program committee and myself concluded that it would be very helpful to have this bulletin discussed. We searched the country for the cleverest men we could find in their particular lines, and it affords me great pleasure to introduce as the first speaker on the program our friend, Mr. F. W. Mitchell, of the New Haven Railroad.

MR. F. W. MITCHELL: Preliminary to this paper I want to tell you that the Interstate Commerce Commission figures for 1920 show an increase in train accidents of 10,717, at an additional cost of $11,500,000. Just think that over a little bit. If we are game fish swimming up stream, why that result? Or are we crawfish going backward?

NEGLIGENCE OF EMPLOYEES

F. W. MITCHELL, SUPERINTENDENT OF SAFETY, NEW YORK, NEW HAVEN AND HARTFORD RAILROAD, NEW HAVEN, CONN.

It is sometimes felt that in the use of the phrase "negligence of employees" to cover the minor, as well as the major, failure to comply with rules or instructions we are casting reflections on employees whose errors of judgment and not of the heart, may have contributed to the accidents.

The meaning of negligence is given as "lack of due diligence or care" but usage and customs have gradually shaded it away from this inoffensive definition, until the word almost suggests the accompaniment of purpose, and often carries an indictment that grates harshly upon the ears of these men in train service, who keenly realize their responsibility and are earnestly endeavoring to fulfill its requirements. Therefore it has seemed to us preferable that in handling this subject through our safety committees, and other agencies, such as accidents should be referred to as occurring "through failure of the human element" although occasionally the results may indicate that the failure was almost a crime.

The statistics to which I am referred in the assigned subject show that 28 per cent of the total number, and 29 per cent of the total cost of train accidents are due to failure of the human element. The other 72 per cent of the number, and 71 per cent of the cost are divided between defects or failures of equipment, maintenance of way, structures, and miscellaneous causes. But the casualties did not follow in these proportions; for 57 per cent of all the fatalities and 52 per cent of all serious injuries are received in train accidents charged to man failures; the remainder coming under the other divisions just named.

I shall try to classify and compare briefly, some of the causes of train accidents, due to man-failure, in such form as will reveal the weaker links in the chain of safe operation which the human element must strengthen.

Bulletin No. 74 records a total of 25,596 train accidents.

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Of this number

15,897	were derailments,	8% of which were due to man failure
6,904	were collisions,	79% of which were due to man failure
2,121	were miscellaneous,	12% of which were due to man failure
503	were locomotive accidents	less than 1% were due to man failure
171	were "Boiler"	33% of which were due to man failure

Analytical Table No. 71 classifies 7,159 accidents, due to man failures, resulting in 279 deaths, 4,043 injuries, into 126 specific causes from which I present the following facts:

TRAIN ORDERS

1. Through failure in handling train orders there were 80 accidents or 1.1 per cent of the total number, 37 persons were killed, 435 injured. Forty per cent of these failures in handling train orders were made before the orders came into the possession of the train crew and 60 per cent were made by the crews.

FIXED SIGNALS

2. In connection with fixed signals there were 191 accidents or 2.6 per cent of the total number. In this class of accidents 43 were killed and 426 injured. Disregard of switch, caution and stop signals furnished 43 per cent, disregard of caution signal 16 per cent, and position improperly changed in face of opposing trains, third in the count of individual causes given, with 11 per cent.

AIR BRAKES

3. The improper use of the air brakes caused 248 accidents, or 3.5 per cent. Four persons were reported killed and 70 injured. Improper release and unjustifiable emergency are the leading specific causes with 29 and 15 per cent, respectively; a relatively smaller, but seemingly discreditable proportion, being "failure to have a proper per cent of brakes in service."

TRAIN FLAGGING

4. Ineffective train flagging was responsible for 284, or 4 per cent of the total train accidents, and involved 20 deaths and 455 injuries. The largest individual cause being total failure to flag, which is 37 per cent of the entire number, with failure to go back a sufficient distance coming next and failure to flag properly—presumably to properly display and use the signals—given in 32 instances.

HAND SIGNALS

5. Hand signals come next in order in this ascending climax, and contributed 629, or 8.8 per cent of the total. There were six fatalities and 161 injuries in this connection. "Misunderstanding," and "failure to give, pass or regard" the signals in about equal proportions, being responsible for 66 per cent of these accidents.

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SWITCHES

6. Switches come next with 949, or 13.2 per cent of the total. The number of fatalities recorded being a relatively small proportion to the number of injured, the figures being 9 and 361. The switch set in wrong position is the conspicuous cause among several others less productive of trouble.

HAND BRAKES

7. Hand brakes contributed 1,122 cases or 15.7 per cent of the total, with 4 deaths and 79 injuries. This cause is sub-divided into "failure to control" and "failure to secure" in proportions of 2 to 1.

OTHER FORMS OF NEGLIGENCE OF EMPLOYEES

8. Finally a total of 3,656 or 51.1 per cent of all causes is included under "other forms of failure," with 156 deaths and 2,056 injuries coming in this classification, the most numerous causes, or disastrous results, are:

	No. of Accidents	Killed	Injured
1. Excessive speed or failure to run with proper care in yard limits or in permissive block	361	16	422
1a. Other excessive speed in violation of permanent orders	99	8	112
1b. Other excessive speed in violation of temporary orders	55	6	74
2. Improper handling of cars or locomotives switching or coupling	490	5	51
3. Failure of conductor properly to supervise movement	262	1	61
4. Running into standing trains or cars not otherwise classified	254	13	165
5. Failure to keep proper lookout not otherwise provided for	238	5	86
6. Cars or locomotives on adjoining track not clearing failure to observe	181	5	74
7. Otherwise fouling switches	170	2	55
8. Joint failure to protect and run with caution in yard limits	124	6	49

These are outstanding causes against which efforts should be directed.

Safety first must be more than a slogan. It must be a controlling instinct that will mingle in proper proportions the impulses from which our actions spring. Individuals, groups and departments must submit to its dominion in all its requirements. A positive curb must sometimes be placed upon haste in order that care may have just consideration.

Mechanical devices have contributed much to the protection of life and property particularly in more recent years and the scope of their usefulness is being constantly extended, but the time will never come, at least

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not in our day, when the importance of reliance upon the human element can be ignored; or when it will not be necessary to direct our energies toward the proper training of the human factor in the equation.

CHAIRMAN CARROW: Mitchell went through this thing in detail. He has enumerated the specific things you have got to work to correct. We are proud to have had such a paper as this, Mr. Mitchell.

The next paper on the program is by Mr. S. G. Watkins.

DEFECTS OR FAILURE OF EQUIPMENT

S. G. WATKINS, SUPERVISOR OF SAFETY, BOSTON AND MAINE RAILROAD, BOSTON

It is said that a railroad cannot be operated without accidents. All equipment is certain to fail sometime and on a railroad where the power is so frequently beyond immediate control, the accident, when it occurs, is likely to be serious.

When railroading advanced to the stage where it was believed to be possible to eliminate or reduce claims for damages by eliminating the accident, I think our first thought was of equipment.

What was defective, or what had failed that resulted in accident?

During the eight years of our safety organization on the Boston and Maine Railroad, we have received over 7 000 suggestions, nearly all of them on unsafe conditions. Over 90 per cent of these have been corrected. Conditions are not yet perfect, but I think it is safe to say that they are so much improved that if we could disregard the accidents that are unavoidable and those caused by human failures, the remainder chargeable to failure of equipment would be negligible.

Referring to Bulletin No. 74, we find of the total number of train service and train accidents, 68,183, 16 per cent or 11.118 were due to failure of or defects of equipment.

In train and train service accidents, 1,693 employees on duty were killed, but only 34 or 2 per cent of the fatalities were caused by failure or defects of equipment.

There were 36,280 employees on duty injured, but only 746 or 2 per cent were chargeable to defects or failure of equipment, and I think we would not be far wrong in saying that defects or failure of equipment were incidents rather than serious contributing factors in train and train service accidents.

There is no way to compute the value of life and limb, and even though the economic loss suffered through failure or defects of equipment is small compared with the total, it deserves our earnest effort from an humanitarian standpoint to reduce it to a minimum, and likewise a property loss of nine and a half millions of dollars through this class of accidents is worthy of our serious consideration.

Considering the accidents and their causes as tabulated in Bulletin No. 74, from the viewpoint of my ignorance of the mechanical problems involved, it would be difficult to suggest adequate remedies. For instance,

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item 94 shows 600 accidents caused by air brake hose breaking or bursting. The first suggestion might be frequent renewal of the hose instead of allowing them to remain in service until they burst, but we find that the life of an air hose is an unknown quantity. They may look serviceable and stand the test, but when put into service may soon burst.

It is said that a train equipped with new hose will have more hose failures than where they have been some time in service. They must be put in service and it is then a question of the survival of the fittest. Replacements are made until we get a full train that will stand the strain.

The history of the car wheel is one of evolution, better materials and better methods of manufacture. Out of all the millions of cast iron wheels in use, item 69 shows but 221 failures and that during the year 1919, when cars were loaded to their capacity.

MINOR CHANGES SUGGESTED

I can see some minor changes that I would make. For instance, I would have the operating lever that lifts the coupling pin extend across the end of the car, so that when a man tries to lift the pin, and it will not operate, he can use the lever on the other car, whereas he must now step in and lift it with his hand or go between the cars to the other side.

The locomotive, like the car, is a product of evolution. In general outlines there has been little change in 30 years, but mechanically, the changes are many. The new engine, broken in and ready to run, appears to be a perfect machine and the failures shown in items 1 to 35 make their appearance as the time for going through the shop approaches.

Many so-called safety appliances have been adopted, but like the air brake and the automatic coupler, each appliance is followed by a train of accidents peculiar to itself, so while the appliance may be an improvement, it is not perfect.

Equipment will improve as man grows wiser, but as long as we have equipment, it must fail sometimes the same as the watch or the sewing machine, the difference being the disaster that follows the failure of equipment where great power is applied.

DISCUSSION

CHAIRMAN CARROW: Gentlemen, we certainly feel grateful for the careful way in which Mr. Watkins prepared that paper. It seems appropriate indeed that a certain representative of the government is present here who is an expert on that line. Many of you will be surprised because you have not perhaps seen him, and it affords me great pleasure to call to the front our old friend and colleague, Mr. F. A. Duffy, who will discuss this subject.

Mr. Duffy, will you please come forward?

MR. A. F. DUFFY: It is a great pleasure to look into your faces, my friends of yesterday, my friends of today, and my friends of tomorrow. I owe it to you members of the Steam Railroad Section of the National Safety Council to thank you for the splendid co-operation you gave to me

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during the time that I was manager of the safety section for the Railroad Administration.

I thank the chairman for the opportunity of discussing the paper that has just been read, but I am not going to respond to it for many reasons. I just want to say, in closing, not desiring to take up any of your valuable time, that I wish you and your families all good luck and Godspeed for the coming year.

CHAIRMAN CARROW: Mr. Adams, you were connected with the I. C. C. in this capacity. Do you wish to discuss this question?

MR. ADAMS: One point in particular that I want to mention in the paper that Mr. Watkins read is that of uncoupling mechanism. All railroads, I want to say first, have a rule that no one is permitted and every one is cautioned against going between moving cars for any purpose. One of the things that all safety men are endeavoring to bring about is the absolute, positive following of that rule. If a defect appears in the uncoupling mechanism, then the man controlling that movement, who is usually the brakeman, switchman or conductor, should stop his train and not go between the cars, and go on the opposite side, if he has to go over or around. I don't advocate going under to get on the other side.

But I am digressing a trifle from the particular point which I wanted to bring out. The question of double levers was discussed in this committee meeting, and it was universally decided that it was a hazard, that it was not a success from a mechanical standpoint. First, it was too heavy; second, it required the use of a chain to connect the lever up with the locomotive that the separation might be made. Hence, the lever was not recommended, but it was not prohibited.

In making these inspections over the country, it very frequently happens, in fact every day one comes in contact with men who use the uncoupling mechanism—not the engine man but the trainman. The trainman should be the man who could authoritatively speak on the subject.

I am satisfied that if you were to take a ballot of all train and yard men as to what uncoupling mechanism or lever is the safest and the most practical, they would say to you that it is the lever that connects immediately with the lock block without the chain, and that the double uncoupling lever would be a menace and a hazard in their work.

CHAIRMAN CARROW: The next speaker on the program is Mr. T. R. McCampbell.

DEFECTS IN OR IMPROPER MAINTENANCE OF WAY AND STRUCTURES

T. R. MCCAMPBELL, SUPERVISING SAFETY AGENT, CLEVELAND, CINCINNATI, CHICAGO AND ST. LOUIS RAILROAD, INDIANAPOLIS, IND.

I believe the best way to correct the defects is through a proper organization for safety, within the maintenance of way department, appointment of responsible men in charge of construction, renewal and maintenance of

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roadway, tracks, bridges, buildings, water supply, track scales, signals and all other structures and appliances.

They shall be responsible for the safe and efficient maintenance, in accordance with the standard safety code on their property.

Obedience to the rules is essential to the safety of passengers and employees and demands the faithful, intelligent and courageous discharge of duty.

A greater number of safety rules fall to the lot of the maintenance of way employees than to any other department, and in order to correct defects and prevent accidents, employees of this department should be carefully trained as follows:

To observe passing trains closely, and if anything dangerous is noted, call the attention of the trainman to the same by word of mouth or proper signal.

In cases of impassable or obstructed tracks, flagging is the first duty.

Work that will interfere with the safe passage of trains, should not be undertaken during fogs or blinding storms, except in cases of emergency.

When necessary to throw switches for loaded push cars or other reason, it should be done by the foreman.

Too many injuries happen to maintenance of way employees, due to their standing too close to passing trains and being struck by objects falling from trains, such as car doors, coal, stone and timbers, also coal from overloaded engine tenders.

MAINTENANCE AT HIGHWAY CROSSINGS

To note that enginemen give proper warning sound with whistle and that bell is rung when approaching highway crossings; to report violations of same, and when working in the vicinity of highway crossings, to protect travelers on the highway from approaching trains. Special attention should be given to maintenance of road crossings, with respect to the safe and comfortable accommodation of the highway travel on the crossing and approaches; remembering always, that good relations with the public are essential to the prosperity of the railroads.

To see that their tools are in safe condition to work with, free from burred heads and bad handles, and that wrenches are not worn to the extent to render them unsafe.

They should be vigilant in the inspection of their districts, going over them at frequent intervals on foot or motor car, observing the condition of tracks, frogs, switches, roadway, drainage, right of way, station grounds, driveways, crossings, fences, track signs, low overhead and guy wires anchored too close to live tracks. Report should be made immediately to the proper officer by telegraph or telephone giving location of any overhead wire of insufficient clearance.

They should see that bridge warnings are maintained at overhead bridges and other structures of insufficient overhead clearance.

Unless they are to be laid at once, rails should not be distributed

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through yards and station grounds, where trainmen and others may stumble over them.

The absence of foot guards in switches, frogs and guard rails is the height of improper maintenance.

Switch rods and connecting bolts should have cotter pins in them, to make sure that points go to their proper position when switch handles are turned.

Special arrangement should be made where two or more switches are so located that their targets or switch lamps might be confused, such as, using switch stands of different heights or setting one stand farther from track by using a longer connection rod.

In cutting rail, a saw should be used in preference to chisel, if time will permit, but when cutting with a chisel, the man holding chisel and the man striking, should wear unbreakable goggles, and the man holding the rail should face away from the cutting. The importance of this rule cannot be overestimated as the records of the claim department will show.

Track bolts should not be broken from rail joints with a spike maul as there is always danger of injuring some one with flying pieces.

In handling rails, ties and other heavy materials, special care should be taken to avoid injury to persons.

TRACKMEN MUST BE ON ALERT FOR TRAINS

Watchmen, patrolmen, track walkers and others, whose duties make it necessary for them to walk on the track, where there are two or more tracks, should, when at all practicable, walk against the current of traffic, keeping lookout in both directions for approaching trains. When working on tracks in places where approaching trains cannot readily be seen because of obstructions such as buildings, curves or cars, a good precaution is to assign one man to warn of the approach of trains. Foremen should educate their men to be alert and watchful to avoid danger at all times.

When large numbers of inexperienced men are working on the track, they should be divided into squads, each squad being placed in charge of an experienced man.

Holes dug near track, should, when practicable, be covered before dark.

The responsibility of supervisors of bridges and buildings cannot be passed over lightly from a safety standpoint. It is up to this class of officials to see that proper clearance is maintained between tracks and bridges, trestles, culverts, docks, wharves, buildings, sheds, platforms, stock pens, stock drenchers, right of way fences, lighting plants, engine houses, coaling stations, turn tables, etc.

Station platforms should be carefully maintained, and any defects that might cause personal injury promptly corrected.

All maintenance of way employees should watch and see that buildings and structures being erected near the tracks, conform to the standard clearance rules. Where for any reason, proper clearance between buildings or other structures cannot be had, caution signs should be placed

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where trainmen's attention will be called to the insufficient clearance before entering such tracks.

Rigging, staging and scaffolding should be put up carefully and it should be known that they are safe before using. Where scaffolding is used in painting structures, on or near tracks, care should be taken to keep ropes and rigging from coming within clearance lines required for train operation.

Ladders on signal and interlocking masts must be securely fastened to masts, bridges and suitable foundations.

All classes of maintenance of way employees that use camp cars for sleeping purposes, should see that such cars are equipped with portable derails and that derails are properly placed when men are occupying cars.

The use of motor cars and velocipedes should be restricted as far as possible and violations with regard to speed of such cars should be reported to the proper authorities.

Much more might be said in respect to safety work in the maintenance of way department, but violations of the foregoing suggestions are to some extent responsible for defects in or improper maintenance of way and structures.

DISCUSSION

CHAIRMAN CARROW: I have no hesitancy in saying that was one of the most satisfactory general outlines of the work that I have ever listened to and we are now pleased to have a discussion on the subject. I noticed that our friend, Mr. Hale, was making some detailed notations, and he perhaps could give us a thought along this line that would be helpful.

MR. HALE: Mr. Chairman, if I may be pardoned for referring to Bulletin 74, I notice the principal cause of accidents is broken rail. It seems to me that should be taken care of by our railroads to see that the best rails are secured and maintenance forces be responsible for removing of rails that have dangerous conditions of wear.

I had some experience in our own test department in examining rails on steep hills with bad curves, as high as 22° curves, and we found we had to take out a new 110 pound rail inside of three weeks on that curve because the head had worn back to the point where the gauge line was over the center of the web. That is one of the items which should be treated.

Another cause of a great many accidents is ties which are decayed or worn. The suggestion along that line is that, so far as possible, replacements will be made with treated ties, for the reason that a treated tie will last longer, replacements are fewer, and the decay which causes the accident thereby made more remote.

MR. CLARKE: It has been our experience that a very large percentage of suggestions offered in safety committees relate in some way to the maintenance of way department, not only for the protection of employees in that department, but to avoid injuries to employees in all departments. It seems to me that the full co-operation in the maintenance of way de-

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partment is one of the most important features of safety work. Buildings will wear out—we have a great many suggestions coming in every month on repairs—floors wear out, planks get loose, and unless the maintenance of way department is maintaining proper inspection, before you know it, there is a condition existing which will cause injury. It seems to me that the crux of the proposition is proper inspection. You can't build a building or a platform or any other structure that is going to remain 100 per cent for any very great length of time. While the stumbling accidents are not the most serious, they are one of the most numerous. These are largely due to either worn out platforms or floors or objects left lying around the yards or along the tracks, so that we need to have the full co-operation of the maintenance of way department if we are going to make a real success of this safety work. We have followed the practice of having members of safety committees supplement the work of the inspectors of the maintenance of way department in reporting these conditions as they appear, and it has resulted in very good work. We have on every committee one or two men who devote half a day a month, and in some cases more than that, to nothing but inspection, and we pay them for that time. They get out and inspect the particular part of the property where they are working, and if they find anything out of repair or in a condition that may cause an injury, they report that immediately to the proper officers, and it is taken care of before the safety meeting. However, everything that is reported and all repairs made are reported in the meeting, to show the work that has been done.

I believe it has resulted in more interest and better co-operation from maintenance of way department men. They have not taken offense at anything that has been reported in that way, and we have found that very often the B. and B. foreman or the section foreman has overlooked hazards that are readily detected by the switchman or the conductor or perhaps an employee in the mechanical department. They are working with it every day, and things that wear slowly they don't catch as quickly as an outside man from some other department. I am very strong for inspections being carried on by members of safety committees in the way that I have outlined.

Mr. Scott: Mr. Chairman, I am very much interested in one feature of Mr. Clarke's remarks, with reference to securing full co-operation from the maintenance of way department. We have with us at this meeting Mr. Arthur Ridgway, who perhaps might be able to tell us how to get 100 per cent co-operation from that department.

Chairman Carrow: Your suggestion is very opportune, and we will ask Mr. Ridgway to do so.

MAINTENANCE OF WAY MEN ON SAFETY COMMITTEES

Mr. Ridgway: Mr. Clarke's suggestion is the only one. I wonder if we all have a section foreman, a B. and B. foreman, a roadmaster, and last but not least, a track laborer on each of our safety committees? I believe that is the only way to get what we want out of them. We have the engineers, and we have our officers to take care of the design of the

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structures, but we want to get these men who have the care of them enlisted on our side of the fence, and it doesn't take any urging. Some of the best committee members known are men from the track and the B. and B. departments of a railroad.

One of the most important things, of course, is the patrol. I don't want to say anything about track walkers or patrolled track because we have them twenty-four hours in the day, night as well as day. But that is one of the most important things we can have, and I am inclined to believe that all of the managements would welcome a suggestion of that sort from us, if you think there is any necessity for it.

But first let's get the track people and B. and B. on the safety committees, give them a chance. You will find them some of the best members we have, as Mr. Clarke says. They want to find out these things, they are ready to correct them. They only want to know about them.

MR. MEGINESS: I would like to say for the benefit of the gentlemen here that in the southwest region of the Pennsylvania System, we have quite a few section foremen and section laborers on safety committees, and I can also say that they give us very valuable information in regard to that part of the safety work.

I would like to also make mention of a case of co-operation which we have in one of our large yards east of East St. Louis, Rose Lake. We have the co-operation of the trainmen, engine force and shop crews in removing obstacles from the right of way. If a bar is out in the yard and a trainman or switchman sees it, it is removed from the danger point. The same way with pieces of coal and pieces of lading which are protruding from the sides of cars or anything of that kind. I can truthfully say that we have co-operation.

MR. MORRIS: I would like to say a little about this subject. We have on the Illinois Central section foremen and laborers on all of our committees, and I want to say that we get some of the very best information from them on points that we should look after; and not only that, we don't have to urge these men to come to the committees, they are always willing and willing to give good points, and we receive an innumerable amount of points that we should correct.

MR. GUILD: There is one point in regard to the paper we just heard, and that is improper clearances. I presume everybody on a railroad, especially in the safety department, who started out along the line of safety suggestions found that during the early part of their organization, over half of the suggestions received were with regard to improper clearances, buildings, poles, trees, bridges and numerous other obstacles that were along the track.

SAFE CLEARANCES FOR STRUCTURES ALONG TRACKS

My suggestion would be, particularly to any railroad that is starting out on the matter of establishing proper clearance on buildings and along the track, that they look far enough ahead to see to it that their structures and buildings are going to be in such shape that several years from now they can still allow for increase in size of locomotives and equipment

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and still maintain proper clearance, because they are going to eventually save themselves a lot of time and money and injury.

In connection with the matter of co-operation in the track department, it is my pleasure to represent the Nebraska Division of the Union Pacific, and I must say that we have one of the best safety organizations in our track department, I believe, in the United States, and it is best borne out by the fact that from the 1st of January of this year up to the middle of August we did not have a single personal injury to a man in the maintenance of way department, which resulted in loss of more than three days' time.

ELECTION OF OFFICERS

CHAIRMAN CARROW: The next order of business is nominations.

MR. MORRIS: I wish to place in nomination for the chairmanship of this section Mr. G. L. Ball, St. Louis and San Francisco Railroad.

MR. BALL: I want to thank Mr. Morris for the compliment, but I really can't under any consideration accept it.

MR. DOW: It seems to me, Mr. Chairman, that this is really a most important subject that has come before this body for deliberation and action. As we have said several times during the course of the meeting in the Copley-Plaza on Monday, and this session since it began its deliberations yesterday, it is most important that the railroads now members of the Steam Railroad Section of the National Safety Council shall retain their membership. It is of equal importance that they shall have as a leader during the coming crucial time in the ensuing year a man who not only has proved by his work that he is an exceptional safety man, but also a man who has the tact and diplomacy to sit upon the Executive Committee of the National Safety Council and see that the Steam Railroad Section gets the best possible benefit and good that we can out of co-ordinating the work of the Safety Section of the American Railway Association with this body.

I have one man in view whom I think that we ought to elect. I don't believe he has been approached as to whether he would accept the election or not, but I believe that he ought to accept it, and I am going to place before you in nomination for the chairmanship of the Steam Railroad Section Mr. Isaiah Hale, of the Santa Fe Railroad.

MR. ADAMS: I move you that nominations be closed and Mr. Hale be elected by acclamation.

CHAIRMAN CARROW: All in favor, say "aye".

The motion was carried unanimously.

MR. HALE: I am almost at a loss for words. I had just briefly outlined a nominating speech, and if I had had a chance to give it voice, it would have proven the lack or absence of wisdom in your choice, because I was going to touch particularly on those traits of character and those capabilities which I know I lack and which peculiarly unfit me for the office of chairman.

It is true that this section today is much in the position of Grover Cleveland when he remarked, "It is a condition and not a theory that confronts me." There are not only conditions confronting us, but problems

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to be worked out within the next year that not only require a certain vision, but, if you will pardon the expression, a certain intestinal investiture which has a much more common name, to approximate a successful conclusion of the year's work.

It would seem that in the chairmanship of the committee on publicity of the Safety Section of the A. R. A., which, coupled with my purely perfunctory official position as one of two or three safety representatives on twelve thousand miles of railroad, I have a rather large job cut out for me this year. I am quite sure, and I go away with that feeling, that the same unanimity and spontaneity with which I have been elected chairman here will be given to me when I come to you during the next year and ask for your help and your encouragement and your assistance. I can't say any more than to thank you from the bottom of my heart, and it is because of my own unfitness that I feel all the greater debt. I thank you.

CHAIRMAN CARROW: The next office to be filled and nomination to be made is for the Vice-Chairman.

MR. SHEDD: I would like to place in nomination the name of my good friend and your good friend, and the good, reliable, efficient friend of the safety movement, Mr. Arthur Ridgway, of the Denver, Rio Grande and Western.

Nominations were closed and Mr. Ridgway was elected unanimously.

MR. RIDGWAY: It is getting near closing time. I simply want to thank you. With my good friend, Mr. Hale, I will try to do my best for the Steam Railroad Section of the Council. Thank you!

CHAIRMAN CARROW: The next order of business is the nomination of the Secretary.

MR. BENTLEY: I think it was Mr. Dow who said yesterday morning that the position of Secretary carried little other than hard work. I beg to differ with Mr. Dow to this extent—in so far as the present incumbent is concerned, he has been accorded the heartiest appreciation of every member of this Steam Railroad Section. It is not, I think, that Mr. Rohweder needs anything that this Safety Section can give him, but, gentlemen and fellow-workers in this grand and glorious cause, we need him. I therefore place in nomination Mr. A. V. Rohweder.

MR. SCOTT: I would like to second the motion, Mr. Chairman, and in doing so to say that it has been a great pleasure to me to be in close touch during Mr. Rohweder's term of office as Secretary, and I have enjoyed the correspondence I have had with him. He has filled the position well, and I think, with our new Chairman, Mr. Hale, our new Vice-Chairman, Mr. Ridgway, and with Mr. Rohweder acting in the capacity of Secretary, that we can all say "Long live the Steam Railroad Section of the National Safety Council!"

On motion of Mr. Morris, nominations were closed, and Mr. Rohweder was elected secretary by acclamation.

MR. ROHWEDER: I appreciate very much the honor of being re-elected as Secretary of the Steam Railroad Section.

ADJOURNMENT.

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Joint Meeting of the Steam Railway Section and the Electric Railway Section

September 29, 1921

JOHN T. BRODERICK, Chairman
Superintendent, Safety Department, Baltimore and Ohio Railroad, Baltimore

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CHAIRMAN BRODERICK: The meeting will please come to order. It is hardly necessary for me to emphasize to you the importance of the subject of "highway grade crossing accidents" and what it means to the railroads of this country.

We have on the program certain gentlemen who have been asked to speak and discuss certain phases of this particular subject. I take the liberty of suggesting in this connection, that we deal with the immediate present in offering suggestions, rather than with the future, and also bear that in mind in giving ideas as to how we can make an improvement and bring about a reduction of these accidents.

COMMITTEE ON HIGHWAY GRADE CROSSING ACCIDENTS

Those of you who were at the meeting of the Safety Section of the American Railway Association on Monday, know that a committee was appointed to handle this particular subject. I happen to be the chairman of that committee, and we contemplate getting started just as soon as possible. We have completed the personnel of the committee with the exception of one man, so there is one vacancy, but we have a good prospect. In passing, I might just give you the personnel of that committee, for the benefit of those who are not familiar with it.

D. H. Beatty, Superintendent of Safety, Southern Railway.

T. P. Brennan, Safety Agent, Long Island Railroad.

H. M. Mayo, Southern Pacific Lines in Louisiana.

J. G. Fitzhugh, Superintendent of Safety and Fire Prevention, Gulf, Colorado and Santa Fe Railway.

J. E. Long, Superintendent of Safety, Delaware and Hudson Railroad.

A. W. Smallen, General Supervisor, Safety and Fire Prevention, Chicago, Milwaukee & St. Paul Railroad.

J. T. Broderick, Chairman, Superintendent of Safety and Welfare, Baltimore & Ohio Railroad.

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There are many things which can be done to reduce accidents of this sort, but I would like to suggest at this time that the whole responsibility and the whole work does not rest with the public—the automobile drivers. I think, from my point of view, from the experience I have had on our own railroad, that the employees and the officers of the different railroads can be of great assistance in this work. For instance, let us take the brakeman switching over a crossing in some yard; he is expected to get off and to flag that crossing in many instances, but we know that is not always done and he sits leisurely and comfortably on his car. We know also that it is the duty of the railroads to keep the roads in proper and safe condition. We know that is not done in many cases.

The first speaker is Mr. F. M. Metcalfe.

GATES, DISTANT SIGNS, AND CROSSING WATCHMEN AS PROTECTION AT HIGHWAY GRADE CROSSINGS

F. M. Metcalfe, Assistant to General Manager, Northern Pacific Railroad, St. Paul, Minn.

Regarding the first item of gates: Through the action of the Grade Crossing Committee of the A. R. A. three or four years ago a uniform style of crossing gate was adopted on nearly all the railroads of the country.

I consider the barber-pole or zebra striped aspect of our present gates a big improvement visually upon the former plain white painted arms that were in general use, and that as protection to the users of crossings, these gates should be ample. Inasfar as their construction is concerned, I have no alterations to suggest. Of course we all know that they do not furnish absolute protection, as some foot passengers crawl under them and some automobile drivers crash through them, but to make crossing gates foolproof would not be practicable.

The operation of these gates is however often subject to improvement. It is the general custom of railroads to fail to display necessary warning notices when gates are not in working order and when gates are not being operated due to gatemen not being on duty during all of the 24-hour period of each day, and this is bound to be confusing to drivers of vehicles from the fact that the gates under those circumstances give a "clear" indication. The public has no means of knowing when a gate is standing vertically that it is in a defective condition or that there is no gateman on duty and therefore considers it safe to proceed. Train, engine and yard men too do not always know that a certain gate is not in operation and they therefore cannot be expected to proceed as cautiously over the crossing as they otherwise might. My opinion is that in these circumstances we should have a uniform method of warning the public and of notifying employees concerned. Ordinarily when a gate is out of order the gateman takes a position on the ground to do his flagging, but it is not infrequent for one gateman to operate gates from one tower for two or more crossings. Under those conditions a flagman should invariably be specifically assigned to protect the crossing in question.

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Occasionally accidents occur from gates being lowered directly upon moving vehicles, because the gateman is so located that he cannot see what is in the pathway of the gates on each side of the tracks when he begins to lower them. This too is a feature susceptible of improvement.

CHANGES NEEDED IN DISTANT SIGNS

The next item is distant signs. This class of sign has also been made nationally uniform by the A. R. A. Grade Crossing Committee, but I think it is extremely inadequate and unintelligible for the very important function it is intended to serve. You all know it is a white painted disc about 20 inches in diameter with a cross and the letters R. R. in black upon it, with one R on one side of the vertical line of the cross and the other R on the other side. It is supposed to represent to the public a railroad crossing, but it does not, and to my mind it represents a waste of a lot of money which it took to make and erect these signs. To illustrate how unintelligible this sign is: sometime ago I was riding with some men in an automobile and as we approached one of these signs one of them said to me "That is a unique ad for Red Raven Splits—the lines represent splits and the R R—Red Raven." Prior to the adoption of this sign we had one which I believe you will concede was much better. It was a red enamel metal square sign about 3x2 feet, bearing the familiar Northern Pacific trade mark and in white enamel an arrow pointed in the direction of the crossing and the words stated that 400 feet distant there was a railroad grade-crossing and to stop, look, and listen. This sign gave specific information and was located at all obscure crossings on the driver's side of the road in line with his vision, but this was supplanted by the A. R. A. sign.

The distance at which this A. R. A. sign is required to be placed from the obscure crossing is 300 feet, instead of 400 as we formerly required. An automobile moving at 25 miles per hour, travels over 100 feet of ground in three seconds. At this very conservative speed we give the driver but 9 seconds in which to take the necessary advance precautions. Were the speed 40 miles per hour, the sign gives but five seconds warning. I consider this item worthy of debate.

That a good functioning distant sign is most essential for accident prevention is obvious. I claim the present standard is not fulfilling that requirement and advocate that this body look to its revision. It is not even rust proof and is therefore often obliterated by rust.

Next comes the item of crossing watchmen.

Last spring I drew up some rules for the guidance of highway crossing watchmen and gatemen which our management adopted as our standard, and as they embody my views on this particular item, I will read them:

RULES FOR CROSSING WATCHMEN

Rule 1. Crossing watchmen and gatemen will report to and receive instructions from section foremen and must not absent themselves from duty until relieved by employees assigned to do so, or, in cases where but one shift is worked, until their assigned hours on duty have expired.

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During hours on duty watchmen must keep a vigilant lookout for all trains and engines and, when they approach, warn persons coming toward the track and prevent their crossing until it is safe to do so.

Rule 2. Crossing watchmen and gatemen must provide themselves with proper appliances for doing their work and keep them in good order and ready for immediate use.

The signal equipment for each watchman will be:

A regulation STOP disc.

A standard crossing watchman's red lantern which has sides shielded and light showing both back and front.

A red flag.

The signal equipment for each gateman will be the same as for watchmen except that in addition he will provide himself with two standard gate lanterns which have sides shielded and a red light showing in the one direction of approaching highway traffic.

Rule 3. When a train is approaching watchmen must place themselves in middle of highway, near the track and by day will display STOP disc, holding it in an upright position so that the flat side will plainly appear to any person approaching on the highway. By night, or when STOP disc cannot be plainly seen, they will take the same position and protect crossing with a standard red lantern with light displayed toward the highway in both directions, care being used not to show the red light in the direction of the track.

When there are two or more tracks, the watchmen will, when practicable, take a position near the track, opposite from the one on which the train is approaching where they can best protect public from trains approaching on other tracks.

Crossing watchmen will, under no circumstances, signal by hand or otherwise for highway vehicles to cross the track.

In case it should be necessary to stop a train or engine, red flag should be swung across the track by day and red light by night.

Rule 4. Where gates are provided, a crossing lamp will, at night, be attached to each pair of gate arms by gatemen, showing "Red" toward the highway and no light toward the track.

Gates must be completely lowered on both sides of track in ample time before approaching train or engine reaches the crossing, and must be kept lowered until such train or engine has passed and until it is known no other train or engine is approaching.

When gates are, for any reason, out of order, gatemen must protect crossing in the same manner as crossings are protected that are not provided with gates. (See above Rule 3).

Rule 5. When a train is switching over a crossing or in case a train has stopped and train is cut so as to avoid blocking the crossing, watchmen must be especially careful and co-operate with the train crew in the safe movement of persons and vehicles over the track.

Rule 6. In case of accidents, watchmen or gatemen must endeavor to obtain the names and addresses of persons injured and of as many witnesses as possible; also obtain the license number on the vehicles involved and the name of the state which issued the license. This information

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should be promptly given to the foreman to whom the watchman or gateman reports. They should also report to him any defect they may observe in the crossing or its approaches which might cause an accident.

Rule 7. In order that watchmen or gatemen's attention to duty may not be diverted, visitors and unauthorized persons are not permitted to enter and loiter about cabins and towers, and the reading of books, papers or periodicals is not allowed.

There is another feature connected with this subject which I think worthy of mention here and that is the quality of labor employed in this branch of service. Circumstance and custom have combined in many cases to place on our crossings for the protection of the public, men who are physically and mentally unfit to perform other service. The big majority of these men have lost their agility or facilities through age or accident, yet they are apparently considered fit to guard the life and limb of the public even though they often are not qualified to guard their own. I think a movement should be begun by us to improve our standard of crossing watchmen and flagmen.

CHAIRMAN BRODERICK: Gentlemen, before we enter into a discussion of Mr. Metcalfe's paper, I should suggest that we express to the management of the New Haven Railroad our appreciation and thanks for the very splendid courtesy that they extended the members and their wives and families of this section, in taking us on the trip that we had yesterday to Plymouth; and I might suggest, if it is in order, that a rising vote of thanks be given to the management for that purpose. All those in favor will please rise.

All those present arose.

DISCUSSION

CHAIRMAN BRODERICK: Is there any discussion of the paper that Mr. Metcalfe has presented?

MR. WILLIAM S. WOLLNER: Some railroads use a sign at crossings where there is only a watchman part of the time, this sign consisting of a cast iron standard with a lamp similar to a switch lamp, but with a lens only in the direction of approaching traffic, showing red, and a disc reading, "Stop—Crossing—Watchman Not On Duty".

MR. E. S. CHAPIN: I noticed in Mr. Metcalfe's remarks he said there was no light displayed along the track when the gate was vertical. On some roads we do show a light on the track so that a trainman approaching that gate will know that the gate is not down and therefore can exercise the caution which, as Mr. Metcalfe said, he might not otherwise use.

In regard to the red light used at the crossing gate, the single light looks very much like the rear light of an automobile and we have had gates broken by automobilists who stated that they thought they were passing to the left of a preceding machine. That led our signal engineer, Mr. A. H. Rudd, to devise a crossing light, which was described and shown by full size models at the meeting of the Engineering Section on the 28th of February last in Philadelphia, in which there were two

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lights, one above the other, showing red. It takes a small electric light to run that, and you can have it running only when trains are approaching by means of track contact, if you wish. It does not require the services of a watchman to keep that light going, and by suitable arrangement of lenses it can be made visible in broad daylight a distance of 300 feet.

That principle of two lights, one above the other, indicating a railroad crossing, I believe is something for which there is a bright future.

Several of the states have adopted the A. R. A. sign as their standard and they are co-operating with the railroads in the installation of the signs. I believe that automobilists generally are becoming used to that sign and its real significance, and I think it would be a mistake to make another change after we have gone so far in what we are doing.

CHAIRMAN BRODERICK: Can you tell us, Mr. Chapin, what states have adopted that particular signal?

MR. CHAPIN: Pennsylvania, Connecticut and New York, to my knowledge.

ANGULAR REFLECTION LENSES MAKE EFFICIENT WARNINGS

MR. L. F. SHEDD: A firm located in Cleveland, I believe, has just received permission from our railroad to install, as an experiment, a certain red glass disc, on our gates, which requires no light, the theory being that the light of the automobile shines on the red disc. How successful it is going to be, I don't know. They have just installed it and I haven't had a chance to look at it. They claim they are using them in various parts of the country, particularly in the East, that is, east of Chicago, with very good success. They also place this same sort of a sign at road intersections and on curves; they don't confine them just to railroad gates. They claim they serve the same purpose, and are unfailing, that any red light that we might put there, which requires maintenance.

MR. BRODERICK: Is that the one made by the people in Canton, Ohio?

MR. SHEDD: I believe it is.

MR. M. A. DOW: We have four or five of those angular reflection lenses, as they call them, placed on our crossings for experimental purposes and I think they are a dandy thing. We went out one night in an automobile and tested one of them and found that the red light would be picked up by the automobile light eight telegraph poles from the crossing.

MR. L. G. BENTLEY: I understand that climatic conditions have no effect whatever on it.

MR. DOW: Our general manager made some study of it, particularly during snowstorms. He reported that even after severe sleet storms the rays showed up as clearly as at any other time.

MR. CLARK: Another point I want to comment on in Mr. Metcalfe's paper is the distant signal. I do not concur with Mr. Metcalfe's conclusion on that. The Automobile Associations of California and Utah and Idaho have placed these distant signals or approach signals a distance of 300 feet from the crossings and they are exactly the same as

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the ones Mr. Metcalfe described, except that the brackground is yellow instead of white, and it has been my experience in riding with the automobile drivers in California and driving in Utah, that practically every one understands what that signal means; it is becoming universal, and in a great majority of cases they heed the warnings. I don't mean that they always stop, look and listen, before they cross the track, but they do know they are approaching a railroad crossing grade.

POWER FEATURES OF CROSSING GATES

MR. SWIFT: A feature that Mr. Metcalfe did not dwell upon in detail, but which in my judgment should be given attention in this study, is the power feature of crossing gates. There are various types of gates—low pressure air, high pressure air, electric and mandrel operated gates—and I know of some instances in our territory where the use of the ordinary low pressure air gate does not seem to give as good results as a manually operated gate can be made to deliver. The reason for that is, of course, understood, namely, that the air operated gate is usually almost at a balance and the air pressure, being very low, is just enough to operate it one way or the other. A sleet storm or even a rain storm will seriously interfere with the balance of the gate, necessitating the towerman or the crossing man leaving his point of duty and readjusting the weights. We have had some trouble with a set of gates of that character on one of the busiest crossings in Chicago. We have substituted at that place a homemade wire operated set of gates in place of the air operated gates, and since the installation of the wire operated gates we have had very much less trouble in breakage of gates than we had before.

MR. E. M. HARRIS: The red light that shows a constant red light under all conditions possibly may not mean so much to some men driving automobiles as to others. I don't know to what extent it is known how good the color perception of all men operating automobiles is, and if there is a failure there, there is a possibility of the red light failing to tell all that it might.

We have on our road the Robinson grade signal, which is a red light which dims and shines thirty times in a minute, coming to a period of great brilliancy and never entirely losing its color in the night-time. In the daytime, at the low points, it is not very perceptible; but in the nighttime, when it comes to the height of its brilliancy, it is a very noticeable signal.

COLOR BLINDNESS A DANGER FACTOR

MR. MITCHELL: I suppose you gentlemen all know that there are a number of stages of color weaknesses. Some people think a man is totally color-blind or not color-blind at all. The experience of twenty years brings out the fact that that is not a fact. Many men stand and balance on a light, just like a tight-rope walker, and don't know whether to call the color red or green. We find that the man with weak color perception measures the intensity of that light. If you could maintain your red lights always at the same intensity, your color-blind man would be

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comparatively safe, because it would always shine right for him. However, if your red light is a little darker and consequently correspondingly dimmer than the other, he measures that out as just about intense enough for a green light. Dr. Churchill, of the Corning Glass Company, makes the statement that a white lens has fifty times as much light as a lens colored blue. White is the brightest; then yellow, red, green and blue. A color-blind man, when the light becomes more intense, thinks it is green one minute, and when it becomes brighter he might think it is green or something else. Many of those men of quite weak color perception will go along all right on those lights until you get two of the same color and one dimmer than the other, and then they give themselves away. In regard to the small lights which represent a crossing a couple of miles away, if he has a bad spot in his eye that the color field is large enough to cover, he will name the color correctly, but if the color field does not happen to be large enough, he will very likely hit upon the wrong color.

Mr. W. W. Fuller: It seems to me we are taking up quite a bit of time on that matter of light here. We, of the Seaboard Air Line, have very few grade accidents at night. I attribute this largely to the fact of the headlight on the automobile, the headlight of the engine. I am of the opinion that the reflecting red light which has been discussed here is very good, but it is not like the majority of lights we have on the Seaboard.

We have, on the Seaboard, a system of posting posters at all of our crossings. These posters are renewed monthly, with some specific positive wording to hit you in the face as you approach the crossing. That gets away from the stereotyped poster referred to by some of the former speakers.

Mr. M. O. B. Campbell: In our experience down in our part of the country, we believe it is advisable to have somebody to visit the crossing watchman, if possible, and go over with him the set of crossing rules. We find that any number of these crossing watchmen have never read those rules, and if they have, they did not properly understand them. Therefore, an order was put into effect that especially in the evening the district safety man was to visit each crossing watchman in his territory and question each crossing watchman as to his understanding of these rules. After this was done, we noticed a considerable improvement in the protection.

Mr. W. H. Fassett: It has been a rule with the Pennsylvania Railroad in Philadelphia that when we have a new man on crossings he is sent to our examining officer and put through an examination in regard to the rules of a crossing watchman, and we insist upon his knowing those rules. If he doesn't know the rules, he must come back again another day and take an examination. Every crossing watchman that we have is examined on those rules. We have several men who are assistants in the safety work and we have made it a point every month to visit some of these crossing watchmen, not only to make an observation of the crossing watchman, but to observe that the trainman properly flags the crossing where there isn't any crossing watchman. If there is a

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failure, that is reported to their superior officers. If it is repeatedly done, of course we have to impose some discipline.

As to the employees on the railroad, every department in train service is required to take an examination, an eye test. I would suggest, and I would also like to make a motion to the effect that every automobile driver, before he is allowed to drive an automobile, be put through an eye color examination.

MR. CARROW: Mr. Fassett, wouldn't your idea be carried out if the matter were recommended for consideration by the Grade Crossing Committee?

MR. FASSETT: That would be a good idea. The railroads are the only people who are being censured for not having the proper lights. We have the proper lights; we put men on the crossings and put them through an examination, but you don't take into consideration the public. I have conducted tests on these different crossings without letting anybody know what I was doing. I arrived at a certain crossing and saw some people run across that crossing and some were standing in the middle of the track, when the signal was up. It is the public we want to get after and nobody else!

CHAIRMAN BRODERICK: As I understand, the suggestion is that it be submitted to the Committee on Grade Crossing Accidents for their consideration, in the embodiment of the plan which they propose to submit.

CO-OPERATION WITH AUTOMOBILE ASSOCIATIONS TO PROMOTE CROSSING SAFETY

MR. ROHWEDER: I would like to just make one remark. I belong to a local automobile club up in our town and I have had considerable conversation with the Minnesota Automobile Association people who, of course, are affiliated with the American Automobile Association. They have felt more or less harsh toward the safety men in this country on account of many things which have been put out. They have said to me up in our country, "Why don't we get together? You get together and pass a lot of resolutions about the negligence of automobile drivers, but still if you drive over the different crossings in this country," (and I have noticed it because I have driven as high as 300 miles in a day this summer) "you find that a great proportion of the accidents are due to the negligence of the railroads."

The automobile people are looking at it from their side, and I should like to suggest that if we are ever going to get anywhere on this, the Grade Crossing Committee ought to take these things and handle them jointly with these different Automobile Associations.

CHAIRMAN BRODERICK: Mr. Brennan, will you kindly present the paper that you have?

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THE VALUE OF PUBLIC BULLETINS AS PREVENTIVE MEASURES

T. P. Brennan, Safety Agent, Long Island Railroad, New York City

By a public bulletin I assume we mean any form of poster, picture, circular, card, letter, photo or other form of information calculated to carry a message to the public. The extent to which such bulletins have played a part is as problematical as their value, for the reason that data on this subject have not been fully collated. Some of the roads have given considerable thought and effort to this, and yet it is difficult to determine to what extent the public bulletins have shown value. When data have been available, as in the case of the campaign for grade crossing accident reduction on the B. & O. Lines, I believe Mr. Broderick's work shows the benefits of the splendid public bulletins he issued. The bulletins issued by his lines are appealing both in subject and appearance. Their greatest value, it would seem, lies in the intelligent and effective plans resorted to in their distribution, where the bulletins were posted so conspicuously and so widely; notably through the mail order houses, in hotels and garages listed in the Blue Book, in automobile schools and clubs, etc., as well as at stations, crossings and other advantageous points.

The analysis, showing, under a test, a reduction from 25 per cent previously to 3½ per cent of those who drove over crossings during a safety drive guilty of failure to use caution, may be due, to some extent to the fact that during a drive attention is more concentrated on the problem specifically considered.

The large and striking poster gotten out by the New York Central several years ago, and its wide distribution, could not fail of good results; and comments on the original—and on the small reproduction of it used as address pasters on shipments of mail, express, feight and baggage—were of a character to justify the belief that these bulletins were effective. Mr. Dow is so modest as to say he "is unable to state what effect it had as to increasing the use of care by the average motorist who saw it." Perhaps we might all be forced to a similar confession if pinned down to the question of producing proof. However, the thing that "hits you in the eye" makes you think.

If I may be permitted to advert to the road I represent—the Long Island—I will ask the patience of those present while I show some of the public bulletins we have issued and cite some results claimed in consequence. In addition to the bulletins exhibited, I show you one more—a six-color bulletin gotten out at considerable expense and circulated through the National Automobile Chamber of Commerce, automobile schools, automobile clubs, posted in hotels, postoffices, stations, passenger cars, at crossings and other points and followed up, periodically, by others, as well as printed preferred position bulletins in the newspapers and by public bulletins distributed through schools, churches and civic bodies.

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1,000 TRAINS A DAY ON 400 MILES OF TRACK

Mr. Bullock, formerly of the National Safety Council Committee on Grade Crossing Accidents, said he knew of no steam railroad in the country having the difficult problem the Long Island is trying to solve on grade crossings. This, of course, is due to the Long Island's highest density of train operation 1,000 trains a day on a 400 mile road, and the fact that its lines operate in three of the five boroughs of Greater New York. Practically 80 per cent of the operation is in congested city territory, and seashore resorts adjacent; and the nearby suburban territory. As a consequence, we have a multiplicity of old streets, farm roads and highways—all demanding attention and justifying the use of public bulletins and the types of special public signs, photographs of which I have exhibited.

The photographs of the large signs warning motorists to use care over grade crossings, as well as the slides shown in the motion picture houses, are regarded by Mr. Metcalfe, of the Northern Pacific, in the nature of public bulletins, which is my reason for exhibiting them in this connection. Mr. Metcalfe expressed the belief that these signs are of great value and should be nationally adopted, an opinion in which I fully coincide.

Mr. James A. McCrea, while general manager of the Long Island, noticed that on that line of only 397 miles, forty persons were killed at grade crossings for the four years preceding 1915, an average of 10 per year. Then began that campaign in safety bulletins, resulting in the appointment of the Grade Crossing Accident Committee of the American Railway Association. Mr. McCrea was made chairman of that committee. How he went to the editor of every newspaper in New York and Brooklyn and had a series of twenty-four life saving bulletins published in all these papers—and in all the newspapers on Long Island—and scattered broadcast, and also shown in slides in all the movie houses in the Boroughs of Brooklyn and Queens and on Long Island, with gratifying results, is known to every railroad safety man. Nearly twelve thousand dollars were spent on this safety propaganda through newspaper bulletins alone in the two years and Mr. McCrea's activity in safety won for the Long Island Railroad the E. H. Harriman Memorial Medal for safety in 1916. It also secured the co-operation of the National Association of Railway Commissioners and the American Automobile Association looking toward legislation in all of the states for standard protection and proper care by drivers of vehicles in passing over grade crossings. The Long Island reduced its grade crossing fatalities from 10 to 1 in 1916 and 4 in 1917.

Then came the war—and Mars and John Barleycorn combined knocked Long Island's proud grade crossing record "bloole", for the year 1918 sent all grade crossing caution glimmering, apparently, with the result that 27 persons were killed in 1918 in the wildest, most reckless kind of driving probably ever known by soldiers and civilians.

The idea that a safety organization, *per se*, was not essential was then dismissed and in 1918 the Long Island organized safety committees and

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renewed Mr. McCrea's splendid grade crossing campaign with the following results:

Grade Crossing Accidents

	Killed	*Injured*
1918 (War)	27	209
1919	10	29
1920	5	7

The humanitarian story depicted by such figures compels attention and the cold, hard, economic aspect cannot be overlooked.

Mr. George L. Wright, Superintendent of Safety Bureau, Chicago, St. Paul, Minneapolis & Omaha Railway Co., St. Paul, Minn., says: "The experience of this line has been that public bulletins have been very valuable in the prevention of grade crossing accidents." He says further that their lines have utilized the bulletins and literature issued by the state highway commissions of the various states through which the lines of the Omaha System operate and had them posted in garages and other places with very gratifying results. Mr. Wright also used these bulletins in connection with his talks before motor clubs and other places.

In contradistinction to the assumed value of public bulletins, we have the case of the Southern Pacific System, showing a reduction of 3 per cent in grade crossing casualties per million locomotive miles, and yet Mr. Clancy informs me they "make no use of grade crossing bulletins on the Southern Pacific, but confine their efforts to analytical publicity through the press and various other sources, with gratifying results."

Mr. Scott, of the Atlantic Coast Line, says that while his experience has been limited in the distribution of such bulletins, he is heartily in favor of doing work of this character because he believes "it is largely a question of educating the people and that by constantly bringing these matters before them, good results will follow."

NOTIFYING AUTO OWNERS OF THEIR UNSAFE PRACTICES

The Pennsylvania Railroad System, the New Haven and other lines have done very effective work with that form of bulletin which specifically notifies the owner of an automobile of each case of violation of safe practice by the driver of such vehicle at grade crossings. Responses by letter to such notifications show a proper spirit and in most cases thank the safety officer for the information.

Chairman T. H. Carrow, of the Steam Railroad Section, expressed the opinion that while it is impossible to determine the specific value of public bulletins as preventive measures, judging from the observations as well as from casual statements on the part of persons reading them it is evident that large posters attract attention and forcibly impress upon the minds of those who read them the necessity of exercising care in driving over highway crossings. His point is that "the public is receptive if the railroads handle the matter in the right way".

Figures showing the large number of persons reported by Mr. Mitchell of the New Haven, to the Automobile Commissions of the states through which the lines of his system operate, would indicate that such form

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caution carries a double value in that it puts the owner of the machine on his guard, not only to protect himself against accident, but also through fear of possible cancellation of his license. This same practice has been in use by the Long Island, although not to the wide extent used by Mr. Mitchell on the New Haven System, and Mr. Broderick on the Baltimore & Ohio.

The mere numerical reduction in casualties at grade crossings, we, of course, all understand does not tell the story of achievement. When we appreciate the fact that the number of automobiles in use in the country today is more than double what it was in 1914 and that the aggregate movements of vehicles over grade crossings due, largely to the motor trucking, is estimated to be five times greater this year than in 1914, the logic of the story is that, where there is no effective protection at such crossings, the casualties should increase in the same ratio. That they have not so increased—and, in fact, have on many lines decreased—must be accepted as evidence that public bulletins have performed a decided part in that percentage of reduction, which, after all, is the problem of each road, contingent upon the local conditions obtaining along their respective lines.

From what I have been able to gather in the matter of opinion generally, as well as from personal observation as a former newspaper man—with such a man's inherent faith in the value of printer's ink—I am led to the belief that the real value of public bulletins as preventive measures is educational and any analysis, difficult as it is, will lead to the belief that every form of public bulletin, like every form of caution sign, brings some help in the reduction in the precentage of casualties at grade crossings.

CHAIRMAN BRODERICK: Gentlemen, you no doubt all appreciate the very thorough manner in which the Long Island Railroad has gone into this particular subject and it has accomplished much.

We will hear from Mr. Arthur Ridgway next.

SAFETY AT HIGHWAY CROSSINGS THROUGH LEGISLATION

ARTHUR RIDGWAY, SAFETY OFFICER, DENVER AND RIO GRANDE RAILWAY, DENVER, COLO.

In considering the subject under discussion, it is first necessary to review the provisions of legislative acts now in effect. Out of thirty-five states responding to inquiries regarding this matter, fifteen have statutes in some way covering grade crossing protection. The other twenty states leave the matter of crossing protection and regulation to the state public service regulatory body by whatever name it is called. A study of the statutes in any way pertaining to the safety of grade crossings discloses that not more than two of the fifteen prescribe regulations of highway traffic.

It thus appears that in most states the requirements are left to the broad powers of the utility commissions, and a review of the orders of

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the various commissions discloses the further fact that almost all of them pertain to the matter of protection by physical means, that is, by signals, signs, gates, etc. Some go so far as to specify explicitly the kind of signs and protective devices which shall be used. Others exact certain conditions and specifications in the construction of the highway grade crossing. A few require the consent of the commission in the creation, abolition and alteration of crossings.

In addition to the orders of the commissions some municipalities have ordinances prescribing certain traffic rules on streets and highways crossing railroads at grade. For example, the city of Colorado Springs has in force an ordinance making it a misdemeanor for the driver of a vehicle to proceed over a railroad crossing if the signals indicate the approach of a train. It is thus perfectly apparent that there is no uniformity of legislation either by ordinance, statute, or otherwise, and that rules and regulations are as various as there are different commonwealths.

There can be no question as to the authority of the state in the regulation of public service corporations. That seems to have been entirely settled. Past experience indicates that utility commissions generally consider their sole function lies in the regulation of public service corporations without vestment of authority over the other party in the case, namely, the public. Perhaps in this they are correct, for most legislation creating regulatory bodies specifically prescribes authority over public service corporations without directly conferring the powers of regulation over individuals or minor government officials.

There can, however, be equally little doubt as to legislative authority in the uses of property dedicated to the public. Similarly, the right of police regulation in the interest of general public safety is not open to question. An analysis of the relative rights of a common carrier by rail, and the public in the use of highways as a means of communication discloses no valid excuse for delay in the enactment of proper legislation and the prompt and rigid enforcement thereof.

HIGHWAY RIGHT OF WAY SHOULD BE SUBORDINATED TO THAT OF RAILROAD

In every state in the union, either by common law, or specific legislation, trains on railroad tracks intersecting at grade are required to come to a full stop before proceeding over the crossing when it is not constantly protected by mechanical or other means. It is not clear then why the same general law in principle cannot be applied in just measure to a railroad track and highway intersecting at grade. To apply the rule literally to this case would, of course, be gross discrimination against the rail line. For example, there could be no justification in requiring a 1,000 ton high speed train or a 2,000 ton freight train to stop before prooceding over a highway grade crossing, as a protective measure against striking a one ton vehicle on the highway. In the matter of personal safety it is to be observed that the average passenger train carries probably one hundred lives, while the average automobile carries but four or five, and it is by no means certain that a collision of the two is not hazardous to both. Again, the principles of mechanics, the

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violation of which is beyond human possibility, dictate that there can be no warrant in arresting the motion of the large body for the benefit of the smaller. Moreover, the necessity of expedition in the conduct of rail traffic is paramount to any conceivable necessity in the use of highways for vehicular traffic. In short, the rail lines are the arteries of our national life, while the highways are at best only a subordinate distributing system, the use of any branch of which might be interrupted, or even permanently discontinued with only local inconvenience. To be sure, the public has the constitutional right of crossing a rail line at whatever point it may elect, but it is equally true that the rail carrier is vested with authority from the state to occupy crossings of the highway in serving this same public. There appears, therefore, no good reason why the use of the highway should not be subordinated to that of the railway at grade crossings.

In only two of the 35 states responding to the inquiry are vehicles required to come to a stop before proceeding over a railway grade crossing, and it seems surprising, to say the least, that such legislation has not hitherto been enacted in all of the states. Whatever the requirements, and however stringent the regulations, perfect uniformity is absolutely essential. Highway traffic with the advent of the automobile has undergone a complete transformation. Long distances in short time are now not only possible of accomplishment, but quite general throughout the country. The automobile takes no cognizance of state boundary lines. What applies to the motorist in Maine should also govern California. It would be entirely too much to expect the driver of an automobile to be acquainted with forty-eight different sets of rules and regulations governing his conduct at railway grade crossings.

UNIFORMITY OF GRADE CROSSING LEGISLATION NEEDED

There are two ways of accomplishing the desired results through legislation: one, through the action of Congress, and the other through the various state legislatures. Since uniformity is necessary, federal action might be considered the easier and more direct way out of the difficulty, but it must be borne in mind that laws without means of enforcement are useless. The duty of exacting compliance will in either case rest with state authorities, and, therefore, it would be far better to have a uniform act passed by each state than a federal act covering the entire country.

Just herein lies the difficulty. It has heretofore seemed impossible to persuade state legislatures to enact identical laws. Apparently then, if there is any hope of relief through legislation, it must come through the efforts of some nation-wide institution, and none suggests itself as better fitted for the task than the National Safety Council. While laws are somewhat useless in reforming the morals of the individual, yet statutes prohibiting an individual from encroaching upon the rights of others have been and are now effective. It is not clear, therefore, why proper legislation regulating highway traffic at railway grade crossings is not entirely practicable, for surely it is most urgently needed.

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Such legislation ought to cover both of the two phases of the matter: First, uniform requirements on the part of the railroads and local authorities in the installation of proper signals, warnings, and other protective devices; and, second, the regulation of highway traffic under consistent penalty for violation thereof.

DISCUSSION

CHAIRMAN BRODERICK: Gentlemen, we now have completed the various subjects on the program that were to be submitted, and we have now reached the point for general discussion. We have quite a bit of time that may be devoted to that purpose.

MR. SCOTT (Wilmington, N. C.): Mr. Chairman, in regard to bumps or causeways at crossing approaches, I would like to say for the benefit of those present that I have with me a copy of a bill that has been introduced into the Legislature of the State of Georgia, dealing with this particular feature, and if there is any one present who would like to have a copy of it, I would be glad to distribute them as far as they go.

BUMPS AS DETERRENTS TO CARELESS MOTORISTS

MR. S. S. MORRIS: I want to say that I have been very active and have assisted some of the different roads in the west in securing data on the mode of building these bumps. They have been very successful around Memphis, where I suppose they have the wildest drivers in the world—I know they are wilder than they are in Boston.

And they would have liked to have murdered me when we put the first one in on one of the speedways down there. However, I succeeded in getting an ordinance passed through the city, in which it was upheld. Then they turned to the city and sued them for damages—broken springs and such things, but in the end the city won out and the bump is still there.

I have an idea that they could, at some future time, invent an automatic signal, so that an automobile passing over a certain depression or trunk, or something of that kind, would be flashed by a light at the crossing. I believe that some signal association should have that worked out. I have talked considerably with our signal engineer in regard to it and I want to say that I believe he will eventually work out something for the benefit of the whole country in that line.

CHAIRMAN BRODERICK: Gentlemen, reverting to the subjects on the program in the order in which they appear, it occurs to me that perhaps some one would like to discuss the subject of Mr. Brennan's paper, "The Value of Public Bulletins as Preventive Measures".

MR. BENTLEY: I think publicity is one of the greatest levers, probably, that the safety organizations of the country can use in disseminating safety propaganda through the country. In a small way that has been demonstrated in Boston within the last few days. So far as I know, the deliberations of this body and the other sections of the National Safety Council now in convention, probably have not acted directly as a deterrent to careless practices in the city of Boston, but we do see

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everywhere in the windows and in the newspapers items and articles of publicity, warning people to be careful. I have great faith in the public bulletin, showing any unsafe practice that we wish to curb.

MR. L. C. BENT: I want to call attention to a bulletin that the National Safety Council got out. It is one of Everett True's. I sent the original drawing and the Council had it reproduced. To those who know nothing about it, I want to call their attention to it. It has met with a great deal of success in Iowa.

MR. CLARK: That bulletin has been put in every station and every place I could find, and I have received a great deal of comment upon it, all favorable. I believe it is a great bulletin which, if reproduced in a little more substantial form, would be of great benefit.

MR. DOW: I assume that the chairman of the Grade Crossing Committee is going to procure from the representatives of the various lines the contributions of bulletins on this grade crossing proposition which they have issued from time to time. I think it is imperative that every member of the organization here, when he receives that request, responds to it and gives the committee full information that it may have something to work upon.

MR. E. E. STOUP: I have in my territory one very busy double track grade crossing. In nearly three years we haven't had an accident on them, although we have had many near ones; but, on the contrary, on single grade crossings we have had two accidents within the last few months, where the driver of the automobile in one hit the third driver on the engine and in the other struck the second car in the passenger train.

CHAIRMAN BRODERICK: The next subject on the program for general discussion is "Safety at Highway Crossings Through Legislation", which was presented by Mr. Ridgway a few moments ago.

MR. DOW: Mr. Chairman, with reference particularly to the law in Illinois, which imposes certain responsibilities upon the automobile driver to use care at grade crossings, while our lines enter Chicago and at some other points touch the state of Illinois, yet we have very few grade crossings in that state, and I should like to hear from some of these gentlemen who have railroads with a considerable number of grade crossings in Illinois, as to whether that law amounts to anything; whether it is enforced, and how it is enforced, and what results, if any, of a practical nature are derived from it. I think it would be quite interesting to know whether it has any "kick" behind it or not.

MR. H. E. MEGINNIS: We go through the entire State of Illinois and I have never yet heard a single case where an automobile driver who disobeyed that law had anything at all said to him.

DIFFICULTIES OF ENFORCING HIGHWAY CROSSING LAWS

MR. RIDGWAY: Mr. Chairman, I think the trouble is that law requires them to stop only at certain hazardous crossings where the utilities commission has ordered the "Stop" sign erected on the approach to the crossing. Of course, they cannot enforce it in Illinois because a fellow

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from Indiana goes over into Illinois in about fifteen minutes and he pleads ignorance and says he knew nothing about such a law. You can't enforce it unless we all have it.

MR. SHEDD: The Chicago papers have been full of an account of the old mayor or justice of the peace over at Posen on the Grand Trunk, just outside of Chicago, who took upon himself the duty of enforcing that law, and he arrested many motorists, until he became notorious because of his activities. I am not criticizing him, but the newspaper notoriety. The Automobile Club apparently fought him. This charge was placed against him, and that charge, and finally he was charged, the last I heard of him, with confiscating or stealing a truckload of whiskey. The thought was this: he may have had some ulterior motive, probably to get the fees, but he was enforcing the law, and immediately he was met with opposition by men who ought to have given him assistance.

It all goes back to that point of fighting all of these things, and I don't think that law is regarded at all by the automobilist in Illinois.

MR. DOW: I don't wish to be understood as opposing the proposition of a law of this kind, which will impose certain regulations upon the drivers of automobiles and other travelers on the highway. I think it would be an excellent thing, provided it can be enforced. I think, however, it is an absolute mistake to have any law which cannot be properly enforced, and this is one of those laws that you never can enforce until you have public sentiment back of it.

It seems to me that in this grade crossing proposition the first thing for the railroads of this country to do, and for safety men to do, is to launch a widespread effective national accident prevention campaign and awaken a public sentiment that will be in favor of regulations of this kind. When you have done that, you not only will get the law because it will come from the people who will be in favor of it, but there will be enough sentiment back of it so you can get enforcement. So, first of all I think we ought to have the campaign.

MR. H. A. ROWE: Something must be done. Every man who has spoken about this great subject has done so feelingly, earnestly and with sincerity, and in most instances having some particularly sad and distressing circumstance fresh in his mind, and yet the cruel slaughter of the innocent and guilty goes on, and it will go on with increasing severity until something is done about it.

I have no panacea for these highway horrors but I may be able to suggest a possible way by which a marked reduction might be effected.

A CAMPAIGN TO FOCUS PUBLIC OPINION ON CROSSING PROBLEM

It seems to me fitting that the Steam Railroad Section of the National Safety Council appoint a very strong committee to bring together representatives from every organization that has seriously considered this nationwide problem and to centralize and co-ordinate the noble efforts being made, and through the agency of this concentrated effort conduct a vigorous and systematic campaign having for its primary object the cultivation of such a strong and decided public opinion that will demand

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the strict observance of necessary regulations at every intersection of a highway and a railway.

When the halo of bravado and defiance is torn from the speed-mad hoodlum who deliberately crashes through lowered crossing gates, who indifferently and sometimes criminally runs down our crossing watchmen, and from the flippant fool who takes the one chance in a hundred of beating the train at an unprotected crossing, and in its stead the finger of scorn is pointed toward him by his fellowmen, then you may look for better results.

Public opinion is the strongest and most subtle weapon in the hands of the people today. No man is so great that he can with impunity continuously defy it; no man is so lowly that he can escape its reproach, and the careful, concerted development of public opinion, putting the burden where it justly belongs in grade crossing accidents, will ultimately have the effect of substantial reduction of this class of occurrences.

I move that a committee of six be appointed, to inquire into the feasibility of co-ordinating grade crossing accident prevention activities and that the committee be empowered to proceed, if the suggestion appears practical.

MR. DOW: Mr. Chairman, I would like to inquire the necessity of such a committee when we have already got a Grade Crossing Accident Prevention Committee which I assume is supposed to cover the entire field of the subject.

CHAIRMAN BRODERICK: As I understood Mr. Rowe's remarks, he referred to the National Safety Council appointing a committee.

MR. ROWE: Probably a little further elucidation is necessary, gentlemen. I simply mean this: that in order to get the results desired we must recognize our own feebleness, we must recognize the fact that whatever we definitely set out for as railroad men will be opposed in certain quarters. My purpose is to gather together representatives from every organization that has espoused the prevention of grade crossing accidents and empower such an organization, if it can be secured, to develop a public opinion not necessarily in favor of the railroads, but with the sole purpose of preventing grade crossing accidents and teaching the public itself, from other than a railroad standpoint, the necessity of carefulness at railroad crossings.

MR. CARROW: The by-laws of the Steam Railroad Section provide that the committees be appointed by the Executive Committee of the Section. There has already been an arrangement for the incoming Executive Committee of the Steam Railroad Section to confer with the Executive Committee of the American Railway Association, and my suggestion would be that the recommendations that you have made be presented to the Executive Committee of the Steam Railroad Section, with the view of taking the necessary action in the premises.

MR. ROWE: And of extending beyond the railroad itself to other interested officers, public utilities commissioners, highway commissioners, etc.?

MR. CARROW: Yes; that is embodied in your recommendations.

ADJOURNMENT.

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THURSDAY AFTERNOON SESSION

CHAIRMAN CARROW: The meeting will please come to order. I now take pleasure in introducing to you Mr. C. L. La Fountaine.

COUPLING AND UNCOUPLING ACCIDENTS

C. L. La Fountaine, General Supervisor of Safety, Great Northern Railway, St. Paul, Minn.

Annual Table No. 75 of Interstate Commerce Commission Accident Bulletin No. 74 for the year 1919 which is to be used as a basis for discussions, shows 108 fatalities and 1,975 injuries due to coupling and uncoupling locomotives or cars. These accidents are distributed among twenty-two classes, each class being complete in itself and clearly indicating the circumstances antecedent to the accident.

In the brief time at my disposal it is not feasible for me to dwell upon each of the various headings under which the Interstate Commerce Commission has classified these accidents, so I will only endeavor to cover the two most prevalent causes as shown in the report, namely: "adjusting coupler, unexpected movement of cars due to other causes," and "adjusting coupler when moving cars were nearing each other."

The first named cause resulted in 22 fatalities and 146 casualties. Accidents due to the unexpected movement of cars are generally the result of a misunderstanding or lack of understanding between the members of the crew as to the work which is to be performed. While definite instructions, the observance of which would positively avert such accidents, cannot be issued, nevertheless, any member of the crew can convey to the balance of the crew, either orally or by signal, knowledge of the work he is about to do in such a way that it will not be misunderstood. A good understanding on the part of all concerned in train and yard service is of vital importance in doing their work generally, but a thousand times more so when some member of the crew is about to put himself in a position whereby an unexpected movement of the cars would result in killing him or maiming him for life.

There is also the possibility, in a great many cases, of slack in cars running out sufficiently to cause an accident of this kind. This is something that is unusually difficult to explain to inexperienced men, except by actual demonstration—even experienced men do not always foresee the full extent to which the slack may run and to a new man the situation is especially full of danger.

There are certain precautions to take that will occur to every practical train or yard man. It is a question which should be discussed frequently among the men—the older employees and officers instructing the younger men in the service how to guard against this hazard either by the setting of brakes or by waiting for brakes to release and slack to run out, as the circumstances might warrant.

Adjusting coupler when moving cars were nearing each other caused 22 fatalities and 204 casualties. Officers and men are agreed that this

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practice is unnecessary and reckless. A common instance is the habit of men stepping between moving cars when coupling is about to be made, usually to determine if the knuckle has been fully opened or to adjust the location of the coupler. In the large majority of such cases, their efforts serve no good purpose in so far as making the coupling is concerned. That such condemned practices should persist in spite of company rules to the contrary is due, I believe, in a measure at least, to the unfortunate fact that such practices were once perfectly legitimate; they are the offspring of the "link and pin age," when train and yardmen had no choice but to go between the cars and make every coupling by hand. Then a maimed hand was a badge of honor and a tribute to the intrepid spirit of pioneer railroading.

The habits of years are not easily shaken off and even after the advent of the automatic coupling devices many of the older men continue the unnecessary practice of stepping in between the cars to adjust knuckles and coupler at or about the time cars are to come together without any fear of meeting with an accident or realizing the bad example they are setting for the new employees entering the service, who naturally follow the examples of their elders with the result that these evils have been handed down through the years.

INSPECTIONS WILL PREVENT MANY ACCIDENTS

As a remedy for these admittedly bad practices, every transportation company should insist upon a careful inspection of all equipment. If such inspection is made, most defects can be noted and remedied which will remove nearly every occasion for men going between cars and engines for the purpose of coupling or uncoupling them. Every train and yard man should be an inspector of the equipment he is called upon to handle in so far as his duties will permit, so that he will know for himself that coupling appliances are in condition to perform their required function. When defects are discovered he should refrain from taking chances. And last but not least, I would advocate a continuance of the educational campaigns which are now in force.

We must arouse in the older men a sense of their obligations as "brothers' keepers" and the new employees must be impressed with the futility of endangering life and limb in the commission of an act which is not only unnecessary, but absolutely forbidden.

We must secure the hearty co-operation of the operating officers to insure that men entering service are correctly instructed and that safety rules are strictly enforced.

That the educational work of the past few years has not been unavailing is revealed by a comparison of the Interstate Commerce Commission reports on this subject for the years of 1917, 1918 and 1919. In 1917 there were 151 deaths and 2,268 injuries; in 1918, 144 deaths and 2,214 injuries and in 1919 there were only 108 deaths and 1,975 injuries. This decrease from year to year, I believe, is accurately indicative of progress made, as the number of employees in train and yard service was undoubtedly about the same for each of the years mentioned.

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Let us hope that each succeeding year will bring similar encouragement; but until these accidents have been reduced to the irreducible minimum, the problem will remain a constant spur to our highest endeavors as exponents of safety habits.

CHAIRMAN CARROW: You will permit me to observe that every one is impressed with a paper that is written by a man who knows what he is taking about. The next speaker is Mr. W. J. Orr.

OPERATING HAND BRAKES AND HAND SWITCHES

W. J. ORR, SAFETY AND FIRST-AID OFFICER, TORONTO, HAMILTON AND BUFFALO, RAILWAY COMPANY, HAMILTON, ONT., CANADA

Brake chains or bolts breaking or giving away: Such accidents are apparently due to defective material and non-compliance with the I. C. C., A. R. A., and B. R. C. requirements which are as follows:

That brake chain bolts be of a minimum diameter of ½ inch; brake chain not less than ⅜ inch diameter, chain $\frac{7}{16}$ inch of wrought iron or steel preferred. The link on brake rod end should be not less than $\frac{7}{16}$ inch, but ½ inch is preferable in order to provide safe application and operation.

Brake chains kinking, twisting, overlapping, or too long: Accidents of this nature are usually caused by chain being too long or the application of improper bottom brake mast support causing chain to become bound or caught between brake mast and sides of support. This condition frequently results in cars getting away in switching operations and may terminate in personal injuries to trainmen and damage to cars and contents. A remedy would be the application and maintenance of proper length chain and properly designed bottom support as required by the Interstate Commerce Commission and illustrated in authorized charts of safety appliances.

Brake shaft broken or defective is generally due to improper welding or welding a shaft when a new one should have been installed. Brake shafts should not be welded except when absolutely necessary as it is against the rules to do so, and is an unsafe practice.

Brake wheel loose or defective may be due to wear, improper taper on brake staff top, or brake wheel becoming defective through accidents.

Pawl or ratchet, defect in or failure of: This is probably due to failure to properly secure bottom of brake shaft, allowing it to rise and cause ratchet pawl to become disengaged. Other causes are defects in material and improper application of parts.

Brake club, standard, breaking is the result of material used in the club not being up to the standard, or improper inspection.

Brake club, not standard, breaking: The use of non-standard brake clubs should be prohibited.

Caught between running boards: These accidents usually occur on freight shed or industrial sidings where curves are extremely sharp. Trainmen should be cautioned against the danger of accident while working under such conditions.

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Load shifting: Accidents have happened when trainmen have attempted to set brakes on open top cars after loads have shifted. Brakes on such cars should be handled very carefully.

The A. R. A. Loading Rules require a clearance of 6 inches between outer rim of brake wheel and any lading for the whole width of the car. It is frequently found that cars loaded with lumber or other light material are so loaded that this 6-inch clearance is only given around brake mast and does not extend for the whole width of the car as required. Such loading creates a dangerous operating condition for trainmen.

Trainmen should use great care in the switching of all loaded open top cars to avoid shifting of the lading.

COMMENTS ON HAND BRAKES

The hand brake has been superseded by the air brake to such an extent that its mechanism is looked upon by some as something that is on the car simply because it is required by the law of the country to be there instead of as an auxiliary to the air brake. The hand brake may be required at any time and should be maintained in good condition for safe operation.

It is easily realized that if trainmen were required to make an actual test of every hand brake before cutting off cars or doing other work in connection with handling cars, they would get very little work done. They expect to find the hand brake in safe working order.

The Interstate Commerce Commission for the United States, the Board of Railway Commissioners for Canada, and the American Railway Association, have adopted rules and standards for the proper application and maintenance of railway safety appliances which include hand and air brakes. These rules and designs are adequate if complied with.

Some criticism is due to trainmen using defective brakes on account of lack of co-operation with carmen. If trainmen find a defective hand brake they frequently do not think it sufficiently important to draw it to the attention of the carman, whose duty it is to make necessary repairs. Defective hand brakes cannot always be discovered by ordinary inspection but generally can be detected while in operation.

A great deal of trouble is experienced due to industrial establishment employees damaging hand brake mechanism and making repairs which are not suitable or permanent. Any repairs made by industrial concerns should be reported promptly to the railroad to whom the car goes.

Attention is directed to the various designs of lever type brakes in use on passenger cars which, while complying with the rules, operate in different ways. Particular care should be exercised when handling lever type hand brakes on all classes of cars to see that dog or pawl is in good order and kept properly in contact with ratchet, so that brake will not release before required to do so. If brake is released prematurely, severe impact or collision may result with possible consequent damage to equipment and personal injuries to employees. Passenger car hand brakes may be required to hold considerable weight due to speed of passenger trains and heavy weight of cars. While passenger car hand

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brakes are very seldom used, it is advisable to test them periodically. A great many bulletins are issued portraying train accidents but I cannot recall seeing one of an accident which was the result of defective hand brakes. The issuance of such bulletins would keep the matter of hand brakes before the men directly concerned.

In the interests of safety it would be expedient to equip with hand brakes all box and other house cars to operate from the deck, and other cars to operate from suitable platforms. In the case of box and other house cars the best footboard or step that can be provided for operating over the end of car is, in a measure, unsafe. The brake operating from the deck of the car with modern brack ratchet and counter-weight pawl can be operated with great rapidity and efficiency.

Some of the causes of accidents due to operation of HAND SWITCHES are:

Switch lever flying up: These accidents are generally caused by the switch points being adjusted too tight by trackmen, or track running on account of weather conditions. They can to a large extent be prevented by careful inspection and adjustment of switches.

Switch lever or ball falling on or catching hand, foot or other part of body: Accidents of this nature are caused by employee carelessly placing hand, foot or other part of body where it might be caught when throw-over switch is thrown. Such accidents can be avoided by the exercise of proper care.

Slipping or falling on ice or snow on tracks or elsewhere: Extra care on part of men using switches when ground is covered with ice or snow would often prevent accidents of this kind. Proper drainage is of course essential.

Tripping, slipping or falling: Yards should be kept clear of unnecessary obstructions. Yardmen especially should become familiar with conditions in their yards so as to avoid tripping over ties, and switch and derail rods.

Struck by locomotives and cars: This generally occurs in the handling of throw-over switches and at a time when the employee is in a hurry and does not look out for locomotives or cars approaching on adjacent tracks.

Sprain or strain, not otherwise provided for: These are mostly caused by switches being out of adjustment and can be eliminated almost entirely by careful inspection by trackmen.

COMMENT ON HAND SWITCHES

I would suggest, if it is not already being done, that instructions be given yardmen and trainmen as to the proper method of operating all types of hand switches, also that if possible all levers on switch stands be made to operate away from instead of toward the main line.

DISCUSSION

Mr. C. W. Hammond: Have you ever ridden cars over a hump when the wind was blowing seventy miles an hour and there were four inches

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of ice on top of the car? If not, you can't begin to realize the importance of that phrase in his paper which recommends that the brake pole be located on top of the car. We have many men on the humps of De Witt and Cleveland who refuse to ride cars over the humps. That is the real proposition we are up against.

MR. E. S. CHAPIN: I have recently seen a model of a brake staff which operates in the usual manner—not a ratchet brake, but power delivered from the brake shaft to the brake rigging. It is delivered through a gear, giving the man on top of the car absolute control of that brake at every point. He doesn't have to wind it tight and hold it. It gives the man complete control by means of worm and gear. There will be no kinking of a brake chain, because there is no winding of the chain on the brake shaft.

MR. W. L. BOSLOOPER: I believe that two-thirds of the defective hand brakes can be traced to the fact that there is not enough attention paid to overhead inspection.

I have had a few years' experience myself, and one thing that men switching cars, especially working on humps, have to contend with is the dish wheel. That is something I believe should receive consideration, because as our railroads are progressing, they are building humps all over the country, and, in a great many yards, they are humping cars night and day. A dish wheel is the most unsafe wheel for braking power that can be placed on the car. There is no brake stick, whether round or square, which can give you the proper leverage. I think that ought to be taken into consideration when we are talking about hand brakes. I have to coincide with Mr. Hammond when he speaks about platform brakes. They are more dangerous on a hump than any other place that I know of. If necessary, this body of men could go to the A. R. A. with a recommendation to do away with the platform brake on box cars and house cars.

CHAIRMAN CARROW: Mr. Boslooper, I take the privilege of delegating you and Mr. Hammond to make an analysis of the causes of accidents under this heading, as it will appear in Bulletin No. 78, covering the statistics for 1920.

The next speaker is Mr. D. E. Satterfield.

COMING IN CONTACT WITH FIXED STRUCTURES

D. E. SATTERFIELD, SAFETY INSPECTOR, CHESAPEAKE AND OHIO RAILWAY, RICHMOND, VA.

It is my intention to show the best way of removing the enemy "danger" from our particular industry.

I think to do this, we might consider the railroad men of this country as an army; and let every employee, from the messenger boy up to the president, consider himself a committee of one to act, mentally and physically; each man to report to his respective officer, as soon as he discovers the enemy's appearance; and let the army go after him and drive him out.

Overhead wire and cables: I find that frequently at outlying points

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some of our country citizens run a telephone wire over our tracks, not with intent to hurt, but through ignorance. Let every employee act as a sentinel and report such things. The coal fields are very good localities to find those conditions.

Material on right of way: This matter, viewed from the safety inspector's standpoint, is one of the most hazardous clearances that we have to contend with, that is, on the commercial track. That track today is normal and clear and safe for our employees to operate under, and tomorrow morning or tomorrow afternoon it is blocked up. Frequently accidents occur by reason of a lumber driver not knowing anything about distances; and the agent in charge of those tracks not keeping a keen watch, and training and educating patrons of that station to comply with the rules and principles of safety.

It is not only lumber drivers, but it is not uncommon to find coal dealers along the right of way. They get their load from the car of coal, and throw it out, and the coal falls right down to the edge of the rails. I contend that is an unsafe clearance; for the man next going in will pass over it, and may slip under moving cars. Sand, gravel and rocks are in the same class.

Buildings, platforms and sheds: I find on the line that I am connected with, that some of our customers will get authority to put up a temporary building for storage purposes. This authority is given in good faith, and it is understood that they will give the proper clearance. I believe before authority of this kind be given, it should be clearly and specifically understood by the builder how and where the building should be erected.

Stock chutes: They are usually put up with a safe clearance; but I have found that they don't always remain so. I don't mean by that the stock chute moved, but that in repairing the track it was thrown over. When a person passes a stock chute with safe clearance today, he has a right to expect safe clearance tomorrow, and for that reason I think it is well that our way employees should be especially trained along those lines—and the same can be said of the yards where the standard clearance has not always existed.

Mail racks and switch stands: Switch stands are frequently made unsafe in the following manner: A switch becomes broken and is destroyed. The maintenance department repairs it by applying the same rod which was broken, setting the switch stand closer to the rail. Nothing is said, until an accident happens; and then we get the standard clearance again.

Sometimes, for the convenience of the employees, the express and baggage trucks are placed in position to receive and deliver charges before the train arrives. We frequently find people injured by this means. I believe that express and baggage trucks should be put up to the train after it has arrived, and moved away before the train leaves, in order to safeguard people.

We have had, in the past eight months, some seventy or eighty suggestions along these lines, by our representatives, although I don't suppose that we are possibly any better off than some other lines; but we do find co-operation with officers is very effective. They get right behind and push these reports.

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I want to impress upon you the fact that we don't get these reports quickly enough; we don't hear of the report, until an accident happens.

In my work as safety inspector, I cannot get over my territory and see all of these defects. Consequently, I am doing everything in my power to have every man, regardless of his occupation, act as my assistant, or be my partner, and report these things. Thank you!

CHAIRMAN CARROW: Mr. Satterfield, we feel grateful to you for your paper.

Mr. Hale, will you take the chair, while the next speaker presents his paper?

MR. HALE: It gives me great pleasure to introduce to you now, he is known to most of us, Mr. D. L. Cease.

WHAT IS ON MY MIND

D. L. CEASE, EDITOR, "THE RAILROAD TRAINMAN," CLEVELAND

The need for saving life and limb is obvious in any occupation that is classed as extra hazardous, and train and yard classes are hazardous in the extreme. When an organization such as I represent, with a membership of 180,000, finds it necessary to pay approximately two millions in death and disability insurance within a year, and it is forced to pay 66 per cent of that two millions because of deaths and disabilities arising out of the service, it does not seem necessary to declare one's belief in the necessity for any movement that will have a tendency to decrease this terrible casualty record.

The personal economic results that must follow death or disability are not confined to the injured or the killed and their dependents. We, however, are better able to visualize the immediate effects of death and disability upon the victims and their dependents than we are to understand the entire situation. Those of us who have been unwilling witnesses to the unnecessary deaths and disabilities incurred by railroad employees cannot understand why each one of them should not welcome every effort made by the employing companies to lessen the danger of his occupation and relieve him in a great degree from the burden of constant danger with its resultant death and disability.

The fact, however, is that there are too many railroad employees who do not take the representations of the railroads seriously because they cannot make themselves believe their employers are willing to give them something for nothing without even being asked for it. Heretofore every concession that has been granted railroad employees has been allowed only after many requests, great expense, and sometimes even at the point of threatened severance of relations. When the companies offer the safety work of their own accord, and principally at their own expense, the men naturally wonder what there is back of it, and too often in the beginning of the work found ample excuse for their mistrust because they believed the companies were pretending they meant one thing with their safety work intended solely for public information, and practiced an altogether different thing in handling their yard and train work. It was not uncom-

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mon some few years ago to find bulletins posted at different terminals calling the attention of the men to the necessity for their observing every safety precaution, laid down in their book of rules, before handling cars. There wasn't a switchman or a trainman who read those rules who did not realize that if he stopped to observe all of their safety precautions that he could not perform the service expected of him within the time allotted. And, this belief was reinforced by the same old-time hurry-up orders of yardmasters and engine foremen, who wanted the work done regardless of safety rules.

The men saw very little of advantage in any such safety work, unless it might be to the company, which could say to the public, we are asking our men to be careful in handling cars and if they are not and they are injured, it surely is not our fault.

RAILROAD IMPATIENCE INTERFERES WITH SAFETY

But, it is difficult to teach an old dog new tracks. You know as well as I know that a switchman, brakeman or conductor who takes his time is not regarded as an efficient employee. You know also that it means time to hold up switching in these days when so many cars are handled at one time. You also know that every operation has back of it the urge to get it quickly done, and you should know that railroad impatience will not stand for much of what seems even in this day of "safety first and service afterward" to be unnecessary delay. You also know that every train and yard man starts to work with the idea of getting done as soon as he possibly can, firmly fixed in his mind. He also knows that every man on the job, from the president down to the engine foreman, expects him to keep that in mind until he is through. It is difficult at times to reconcile the thought of safety first and hit the ball at the same time.

It will take another generation to change this condition of mind. Danger, disability and death always were supposed to go hand in hand with a job in train or yard service. I can remember the time when an applicant for a job was told to come down when the day's run came in and see if any one had been killed. This was on more than one road that ran into my old home town, and the saying was no joke; it was in dead earnest. In that day a man was not considered a good railroader unless he had been car bit and could show the marks. A man with all of his fingers could not qualify as a veteran. More than one prominent citizen carried an empty sleeve, or had the empty leg of his trousers tucked in his hip pocket. It was all considered as a part of the day's work. This heritage of death and disability has not been altogether removed from the present generation, but thanks to safety work it is going and going fast. It must be our united work to overcome the traditions of all of our railroad years, to have our railway men realize that the railroads are in earnest in trying to save their men, and to get down under the hides of the men and their immediate superiors with the fact that safety means what it says and that unnecessary injury and death will mean discipline for the personal cause of either, if he can be reached. And, in this connection I feel perfectly justified in saying that if the em-

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ployers are at fault that they should be made to pay to the fullest extent for their neglect to provide ways and means for the safe performance of their service.

These are illustrations that do not in any wise reflect upon the fair operation of safety work. I have no criticism of it, but to the contrary I have the greatest commendation for the work that has been done, but I do hope that something can be done by someone that will compel every officer and employee literally to obey the rules that are laid down for the protection of not only their lives, but the lives and property entrusted to their care.

I have every confidence in the ultimate results of teaching men that they must save themselves. We are going to succeed, and we are going to overcome the heritage of dangerous railway practices. We are going to teach men that they must help to save themselves and each other, to protect their families from want, to save themselves from the poorhouse, to save the organizations from paying millions unnecessarily, and to save for the railways and the country the best set of railroad employees the railways ever had. But, we must carry conviction of honesty with our safety first propaganda; railway men must be made to understand that unnecessary risk is not going to be tolerated, and that above everything else the railways mean everything they say when they advise safety first and service afterward.

HOW THE MEN LOOK AT SAFETY WORK

I thought it might be agreeable to this meeting if I offered the opinions of some of our own men in regard to the movement. I wrote to a number of representative men in my organization, men in whose judgment I have confidence, and I am going to quote very briefly from their replies:

No. 1—"In my opinion safety first has resulted to some degree in saving life and limb, but it is not fairly administered. The men are not given the protection they should have. The employees are required to take unnecessary risk in violation of rules in order that their superiors may make a showing for themselves. Men are not given protection when sleeping in cabooses, which they should have by providing caboose tracks in order that they may be protected from switch engines and cars colliding with cabooses. Trainmen sometimes are required to work with cabooses in winter that cannot be kept warm, and in some instances are so badly in need of repair that employees are afraid to ride in them. Safety is observed by the management if it does not cost the company anything. Sidings are in bad repair, and the wonder is that employees can so well protect themselves from injury. It does not appear the system is properly operated."

No. 2—"During the period of government control we had a so-called safety first committee with our claim agent as chairman. He filled the records with flowery talks about cost and the general manager, but the fact remains that nothing was done that cost money. The first item that was presented to the safety committee by the yardmen was tabled. We have no such committee at the present time, and as far as we are concerned we do not care for one unless we have a real voice in its affairs."

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No. 3—"While the roads were under government control we had considerable success with the safety movement. The cost of remedying poor conditions was not taken into consideration. Reforms were made, and the men generally were satisfied with the safety work. We were not entirely successful in getting men to take as much interest in safety as we desired. They felt that it was more talk than anything else, although later on they accepted it as it was represented to them. With the return of the roads to private control, however, the efficiency of the work has practically been discontinued and it is unusual to secure any results after complaints are made of unsafe conditions."

SAFETY WORK BRINGS 69 PER CENT ACCIDENT REDUCTION

No. 4—"Safety work is fairly administered and has resulted in the saving of life and limb. The Northern Division, 300 miles, did not have a reportable injury of any kind in March, April and May. The Western Division, 375 miles, has gone 163 days with but one reportable injury to an employee, that occurred on the 127th day. It was a slight scratch which afterward became infected. For the first five months this year there was a reduction of 69 per cent in train and engine service accidents per 100,000 engine miles, and of 45 per cent in industrial accidents per one million man hours. We believe this is good work and with every employee doing his best the safety movement will bring wonderful results."

No. 5—"Safety work on our line has been handled in a very creditable manner and the results have been good. We have been able to get safety conditions improved that we were unable to get in any other manner. There is a lack of interest in the work for the last year due to the fact that practically all of the safety measures asked for have been adopted, and because the safety managers have not kept up the spirit of safety enthusiasm. Life and limb in train and yard service have been conserved, and a mistake is being made by both the management and the employees in not keeping up the proper interest."

No. 6—This letter complains of a lack of interest which is due almost entirely to the mistrust of the employee. The reason for it is based on the statement that every wage increase and working condition obtained in the past has been granted only after an expenditure of a great amount of money and effort. It is not to be wondered at that a new movement sponsored by the same railroad is looked on with suspicion by employees who have had to fight for everything else they received from their employers. The long years of constant opposition have drilled into the employees the belief that no substantial betterment of conditions can be gained, except by fighting. "I find," declares the writer, "almost a universal feeling that an ulterior motive exists somewhere and there is a common disposition that the employee is conferring a favor by complying with the railroads' request that he play safe." The writer takes the position also that the safety movement cannot be taken seriously until the questions of wages and working conditions can be based on practically the same policy that is presented in the safety work. Despite the criticism and the expressed doubt of the applicability of the safety

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first work on this road, I am satisfied that Mr. ———'s statement of what the safety first movement means to employees will show most conclusively that despite criticism safety work has resulted in a great saving of life and limb to train and yard employees.

UNSAFE CONDITIONS AND PRACTICES PROMPTLY CORRECTED

No. 7—The writer states: "I suppose there was no one more skeptical than I was when told that such a movement was to be inaugurated. I was elected as one of the Chicago Division safety committee. As far as this division is concerned, every complaint or suggestion made was carried out religiously. Wherever it was shown that an unsafe practice or unsafe condition existed, it was promptly corrected, and I believe the statement holds good for every division on the system. I could name many, many corrections of unsafe conditions, but the one that appealed to me most was the positive, ironclad instruction that men should not go between cars for any reason while cars are in motion. Obstructions in and about places where yardmen are working have all been removed. The yards have been cleaned up, overhead structures protected by tell-tales, and in winter time yardmen are positively prohibited from working with engines that have footboards with ice or snow on them, no matter how long it takes to remove it."

No. 8—"The safety work has done considerable on our line, and I think it was a great blessing, particularly under government control, and while they are still doing everything they can for safety, I do not believe there is as much power behind it at present as there was before."

No. 9—"There has been a considerable improvement in the safety work with the good results that naturally follow. Safety work on our line is being well handled and if present efforts are continued the hazards will be reduced to the lowest possible minimum."

SUBORDINATE OFFICIALS NEGLECT SAFETY

No. 10—"Members of the Brotherhood who have for many years been chance takers have listened to the pleadings of the safety committee and have been practicing what it has taught. I am positive there has been a decided falling off in the number of personal injuries. Our members practice the teachings of safety and a few years ago scoffed at it. Safety work is fairly administered, but I feel impelled to say this, regardless of the effort of the management, regardless of the expenditure of funds, the principles of safety will never become fixed until subordinate officials are advised specifically that safety must be given the right of way over time. Delay seems to be considered a mortal sin and must be eliminated regardless of the safety of the employee. As long as the management permits subordinate officials to wink at safety practice in order that delay may be eliminated safety will progress slowly."

No. 11—"Safety work on our line has done a wonderful amount of good and surely saved many lives and injury to others, and my belief is that our safety department was sincere in its efforts and received the support of the officers. After 23 years' experience as a yardman in the Chicago

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territory, I say that too many nice things cannot be said in behalf of safety work. It would not be fair to say there is no room for improvement, for like every other big thing it takes time to bring it to perfection. It is also true that some of the minor officials are not as sincere in this matter as they should be, but on the whole I believe it is a mighty good thing, and I am for safety at all times. I regret to say that the business depression has just about wrecked the safety organization on our line, but we are anxiously awaiting the return of our safety representatives to their former positions in order that the good work may go on."

"CORRECTIONS NOT MADE IF THEY COST MONEY"

No. 12—"In the beginning we found that when a suggestion did not cost much money it was generally approved and some dangerous conditions were improved, but other dangerous conditions that cost something, such as proper clearance between tracks, were not taken care of. The employees lost interest and said if it cost money that the corrections would not be made. However, interest in safety has been stimulated and I believe that a genuine desire exists among the employees to avoid dangerous practices and report unsafe conditions. I attribute to the labor magazines some of the interest that is being shown. Employees have learned that in reducing the number of deaths and disabilities the insurance paid by them promises to be reduced. This railway could inspire more confidence in the employee by showing him that it places life and limb above the dollar, which will convince the men that there is a genuine desire for the proper application of safety first."

No. 13—"I really and truly believe that the propaganda issued by safety departments has resulted in the saving of life and limb. If the safety department can drive home to employees the value of precaution, that is. the necessity for assisting in the prevention of accidents to themselves as well as others, to not make a move unless it is known to be safe, to adhere to and religiously follow out rules with reference to coupling cars, it will accomplish a great deal and the department will be a more valuable one to the employees and their families, as well as to the railroads. There is unquestionably a certain amount of good derived from safety work. I do find, however, that our men have become discouraged because the railroads do not approve promptly many of their recommendations for changes that would bring about safer working conditions."

No. 14—"It is my honest opinion that the safety movement resulted in the saving of life and limb during federal control of railways, at which time it seemed that there was an interest being taken in the work by both officials and employees, but since the government relinquished control of the railroads it does not seem that there is much interest in the safety movement from either side. The employees seem to think that the railroads approve safety only when it does not cost. This impression is grounded on the complaints of the men on unsafe conditions and failure to correct such conditions due to lack of funds."

No. 15—"Our company takes action when its attention is called to anything in the interest of safety, and while there is negligence on the part of the employees in not properly reporting matters, we have no reason to

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believe our company is not acting in good faith. The railroad should be given to understand that some of the men are timid in reporting unsafe conditions and practices fearing that if they are continually doing so they may be singled out as kickers and undesirables. It is a fact that this movement has resulted in the saving of life and limb, but I believe it could be improved upon by the expenditure of a little more money in walks along the sides of culverts and bridges for the protection of employees."

No. 16—"I have never noticed any activity that I would commonly expect to find with an active effort to promote safety committees and work. The safety movement has not accomplished much on this road. This is my opinion formed from observation of the men, as I am in actual service and a member of the safety committee. I cannot honestly attribute any lessening of accidents or saving of life to it here. There is no question of the honesty of the officials. It appears to be made a matter of indifference."

"EMPLOYEE GREATEST OBSTACLE TO SAFETY"

No. 17—"There is no doubt in my mind that safety work is the greatest conservator of life and limb that has ever been introduced on the railroads of these United States. The employee himself is the greatest obstacle to the perfect fulfillment of the intent and purpose of the safety movement, that is so far as unsafe practices are concerned. During the first three weeks of last November I personally warned 23 employees of the unnecessary danger assumed in kicking over drawbars. I am still calling the attention of some of the men to the same asinine practice. They seem to take a special delight in doing this because it is prohibited. Perhaps through the grace of God rather than the carefulness of the men no one has been injured. The question of unsafe conditions is another matter. This road is handicapped on account of the lack of funds and many of the recommendations as to the elimination of close clearances, removal of telephone and telegraph poles between tracks, and a thousand and one things that go to contribute to the daily hazards of the train and yard men, have all been given consideration, and where the cost was not too great the condition has been remedied. On the whole, safety work is primarily and fundamentally educational, but the rules in themselves are nil if the men themselves do not obey them. Safety work is being fairly administered so far as the finances of the company will permit."

No. 18—"I beg to advise that safety work is carried on just as fairly as money and time possibly can make it, and no department is given more consideration by those in authority than is the department of safety. On account of the great care and time given it the loss of life and limb in train and yard service has been reduced to a minimum. In every instance where an employee in train or yard service is injured a most thorough investigation is immediately made for the purpose of determining the cause of such injury, and if it is developed that the injury is caused on account of the employee being required to violate any of the safety rules, any and all of those involved in issuing such orders are immediately dismissed from the service. Employees in train or yard

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service who knowingly and of their own accord violate any of the safety rules are promptly dismissed from the service."

I have an opportunity to see many men who have been injured in the service, and I find altogether too many of them who can attribute their injuries to chance taking. We find very many men come to us for the adjustment of their insurance claims who have injured their hands or feet in coupling. I always ask them, how come? The usual reply is, I tried to adjust the coupler with my foot. I ask, did you have to do that? The invariable answer is, no, not exactly, but if I held up the job I would have been bawled out, and if you don't hit the ball you don't last. This is the thing we have to overcome, for in my opinion, it is the curse of old time dangerous railroading, now unnecessary, that must be gotten out of the minds of our men, for too many believe it still is the only way to railroad, and this opinion is not confined to the men alone, but is shared to altogether too great an extent by their superiors.

MUST DISCIPLINE EMPLOYEES RESPONSIBLE FOR ACCIDENTS TO OTHERS

When I was asked to come to this meeting I had something on my mind that was not pleasant. That day I had witnessed the examination of one of our men who had been unnecessarily deprived of the use of his arm for the rest of his life. It is the old story of a switch foreman becoming impatient while a man was between cars making adjustments and giving a signal to the engineer, to back down, without waiting for the switchman to get out. The result was that he was caught and maimed for the balance of his life. The only way, in my opinion, to get around instances of this kind, that may be called the results of temperament, would be to discipline the party responsible for the happening in such a manner that never again would he be in a position to cause the death of a railroad employee. A man of that temperament, who will deliberately set a trap to maim or kill another, surely does not deserve a place among railroad men.

Not so many years ago a road conductor told me in detail of an experience of his, which forced him to go under his train while it was switching, without advising any of the crew, to make some necessary adjustment, which if not done would have meant train delay. I asked him why he did it. He said if you are going to run a train and hold your record for getting over the road you will have to take chances like that. If you lose your record you may as well let go of the rest of it, for it will get away from you anyway. Thanks to safety work, I believe that such chance taking is not regarded as necessary now.

A short time ago I was at a terminal. A passenger train came into the station. A car inspector coming down the side of the train discovered a loose dynamo belt. Without advising any one that he was going under the train he did so and used up at least three minutes in releasing the belt and getting it and himself back on the platform. In the meantime a switch engine drifted down to the hind end of the train. The two switchmen were on the front end, of course, and when about six feet from the train one of them jumped off the step, gave the engineer a signal to stop

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and walked between the moving engine and the train without knowing whether the engineeer had seen the signal, or the engine would stop. Fortunately the engine stopped. Here were four violations of safety rules on one train happening within three minutes. I happened to be talking to an employee at the time, and I said to him, "Have you no safety first practices on this road?" He said, "Yes, our officials are trying to have the men stop practices of this kind, but that is about all it amounts to." Had any one of these three men been killed, it would have been his own fault. There was no need for any of this chance taking for there was no switching done within at least five minutes after the train pulled into the station. I cannot but hold that men who are so indifferent to their lives and limbs are not safe employees to be trusted with the lives and limbs of their associates.

I then have a letter from the Chicago and Northwestern that I am quite sure will meet with the approval of every one present, which, in part, reads as follows:

"The safety first movement has been in effect on our line quite a number of years and I believe I am safe in stating that our people have done almost everything in their power to do by it all that was intended by such a movement. Our general claim agent, Mr. R. C. Richards, is really the father of this movement and is sincere in all of his undertakings, and is deserving a lot of credit for its success.

"Every division has a committee and they have been meeting at least once a month. At such meetings all safety matters are presented and discussed and ways and means are then undertaken to try and correct any matters which appear to be not covered. Mr. Richards frequently visits different points on the system and gives a general talk on the subject and encourages this work. Bulletins are also posted from time to time showing just what is being done in the way of saving and protecting life and limb, which shows that the work is doing about everything that can be done along these lines, and I believe I am safe in stating that it is being fairly administered on our line, and that it is actually resulting in a saving of life and limb. While I assume that there is room for improvement, yet, I can frankly state on our line much good has been accomplished through this movement."

These letters have been presented to you from among very many that have come to me in reply to an inquiry concerning the administration and value of safety work on several of the lines. The letters are typical and are submitted to you without further comment.

In leaving you, I am very glad to have had this chance to be with you, and in closing my altogether too lengthy remarks permit me to say that we, who are aware of the purposes behind the Safety First Movement, appreciate to the full the efforts of the railway companies to conserve the lives and limbs of their employees. Let the good work not stop with this Conference, and let us not slip back into the every day habit in which so much performance is more perfunctory than real. We will promise you every consistent co-operation. We will go into this work and carry it forward just as far as you dare go. And, let us adopt a sort of mutual understanding to this effect, that you are going back home to

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take up the work of saving men, and I will go back to take up the work of trying to interest men in saving themselves.

CHAIRMAN CARROW: We are forced to limit the discussion on that paper to Mr. Shedd.

DISCUSSION OF MR. CEASE'S PAPER, "WHAT IS ON MY MIND"

L. F. SHEDD, GENERAL SUPERVISOR, SAFETY AND FIRE PREVENTION, CHICAGO, ROCK ISLAND AND PACIFIC RAILROAD, CHICAGO

Rather than to attempt to discuss Mr. Cease's paper let me emphasize the splendid thoughts he has brought to us.

(a) "Hard to teach an old dog new tricks"—Mr. Cease realizes the truth of this old adage and to some of us who are privileged to have been connected with the safety movement for a considerable time and who have taken an active part in the educational efforts to prove that safety was a paying investment, that adage presents the same truth, but we must keep on trying, feeling assured that we are gaining ground at the setting of every sun and with the added efforts and co-operation of such men as Mr. Cease, through the columns of his valuable publication and like assistance, we must win and win we will.

(b) Employees failing to take the safety offer of the railroads seriously: This is one of the features of our work that has caused all safety department heads and field workers considerable trouble and has been more or less a stumbling block in the path of safety progress. We all know how skeptical some of the railroad men were when the safety movement was first launched a dozen years since, and at the present time there are still a few such skeptics. But it is plain to be seen that the days of the disbeliever are few and it therefore behooves us who are charged with the detailed handling of the movement on our respective railroads to continue, and if possible increase, our efforts to convince the few outstanding skeptics that the safety movement is for the benefit of the fellow who handles the switch list, who shovels the coal, who controls the throttle, who maintains the road-way, the buildings, etc., and is not a movement that will benefit the management, except in so far that when those who are faithful to their trust are saved from injury, the management wins and the employees win with the management—both are benefited and the home receives the greatest blessing of them all. The railroad man of today as a rule is open to conviction. We represent a cause that will stand the acid test of criticism. Let's invite inspection and constructive criticism of ourselves, our methods and of the work we have in hand and when we find that our methods are wrong, when either employee or subordinate officer is not responding, then personal interest and proper procedure to convince of the movement's sincerity should be resorted to with increased vigor.

RAILROAD ORGANIZATIONS SHOULD FALL IN LINE FOR SAFETY

(c) Interest should be taken by the railroad organizations: The safety movement, admittedly based upon humanitarian welfare, should

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be carefully studied and accepted by the railroad organizations, because such organizations can be greatly benefited if their members are not crippled and killed. However, for the sake of a business comparison, let us suggest that even if the only results accruing to the organization would be financial, would it not be an inducement to take advantage of a movement that would lessen the assessments and protect the treasury? The statement of Mr. Cease that the organization he represents, having a membership of 180,000 finds it necessary to pay approximately two millions in death and disability insurance within a year, and it is forced to pay 66 per cent of that $2,000,000 because of deaths and disabilities arising out of the service, and then adds, "It does not seem necessary to declare one's belief in the necessity for any movement that will have a tendency to decrease this terrible casualty record" might well be used in presenting the merits of the safety movement to the men in railroad service wherever found.

In conclusion, let's resolve to push our work and increase our efforts to conserve life and limb to every corner of the railroad world; to reach every railroad man; to stimulate those who are doing their full part to make the accident prevention movement a success and to win, through proper and consistent channels, those who may still doubt the value or the sincerity of the safety movement, its founders or its ardent advocates, ever bearing in mind, and never failing to advance the thought that successful achievements in preventing loss of life and limb will reflect credit not alone to men and management alike, but the sharing of the "profits" will be participated in by community, state, country and the home. Let's prepare our "case" so well and so efficiently that when presented to the "jury of all America" we are assured of a verdict in favor of the movement we happily represent and be ever mindful that through the safety movement, we are building for the future of America and her people.

Mr. Hale: We all know that the worthy chairman is sitting there raring to go on. I take pleasure in turning the chair back to him.

Chairman Carrow resumed the chair.

Chairman Carrow: The next speaker on the program will be Mr. E. M. Harris.

GETTING ON OR OFF ENGINES OR CARS, FALLING FROM ENGINES OR CARS, STRUCK OR RUN OVER BY ENGINES OR CARS

E. M. Harris, Safety Inspector, New York, New Haven and Hartford Railroad, New Haven, Conn.

The figures which we are using today in these discussions give a total of 42,587 train service accidents, exclusive of 4,901 casualties to trespassers only.

There were 7,662, or 18 per cent of the total number, received while getting on or off cars or locomotives.

The total train service casualties exclusive of trespassers is 45,786, of

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which 7,768, or 17 per cent, were received in getting on or off cars or engines.

We find that 30,998 or 67 per cent of the total number of casualties were received by trainmen on duty and of this number 5,869 or 19 per cent were received in getting on or off engines or cars.

There were 3,661 casualties to other employees on duty of which 385 or 10 per cent come under this classification.

Employees injured or killed in train service accidents while not on duty numbered 333 with a total of 62 or 18 per cent injured getting on or off engines or cars.

There were 3,339 passengers killed or injured in train service accidents with 1,353, or 40 per cent of the total casualties, received by getting off or on cars or engines, 450 persons carried under contracts were injured with 47 or 10 per cent receiving their injuries getting on or off cars or engines.

Other non-trespassers injured in train service accidents total 7,007, but only a fraction of 1 per cent were injured getting on or off cars or engines.

In taking up the specific causes and classifications we find that stepping or tripping on coal, stone, boards, rubbish or other loose refuse material or into holes, and falling, slipping, tripping not otherwise classified, furnished by far the largest count with a total of 2,684 or 34 per cent of the total number reported. Brakemen, flagmen, switchmen, etc., suffered 65 per cent of these accidents, the remainder being distributed between other employees in train service in about equal proportions with a somewhat larger proportion confined to passengers.

Defective steps or ladders contributed .03 per cent of the casualties listed here, while missing their hold or slipping on steps, platforms, etc., where no defects were noted, not included in other comparisons, caused 34 per cent of the total from this cause.

Slipping or falling from coach steps caused 1,052 or 14 per cent of all casualties; getting on or off cars or engines, 73 per cent of these were passengers.

Jumping in anticipation of an accident caused a total of 826 or 10 per cent of the total in this classification table. This class of accidents was almost entirely confined to employees.

It is well to notice that in the total of 4 killed and 18 injured by stepping upon the front footboard of locomotives we find the largest proportion of fatalities to the total number of accidents that any classification under this heading records. The New Haven Railroad forbids this practice entirely, and also restricts the number who may ride on the front footboard.

From table No. 82 of the miscellaneous information, it appears that there were 3,220 casualties from falling from cars or engines, or struck or run over by cars or engines.

The largest specific item is recorded under "struck or run over not otherwise classified," and its victims are in large measure among employees from other than transportation service, and among those listed as "other non-trespassers." The number of casualties was 2,115 or 65 per

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cent of the total number. Close clearances of cars or locomotives on adjacent tracks and coming against cars placed for loading or unloading are the only causes given which attract attention by standing out in excess of other causes.

We should note that cars or engines coming against cars being repaired unprotected resulted in 29 deaths and 78 injuries, the only place where there was a larger proportion between deaths and injuries being the items "struck on private crossings," 61—85, and the previously considered item, "struck or run over not otherwise classified," 841—1,274.

The figures which I have presented were gathered from tables which do not clearly define the nature of the accident under all the headings assigned to this discussion.

The chairman of the Steam Railroad Section expressed the thought at the last convention that our men did not need so much to be taught as to be reminded.

Our safety bulletins serve as teachers and reminders. If the figures brought out in these discussions and placed at our immediate disposal can be released to the rank and file of the great army of railroad workers by means of our National Safety Council bulletins, it will be a real addition to the practical value of these discussions.

CHAIRMAN CARROW: The next speaker will be Mr. W. H. Ganzert, of the Chesapeake and Ohio Railway.

WORKING MACHINERY; USE OF HAND TOOLS; BURNS, SCALDS AND PUNCTURES

W. H. GANZERT, SAFETY INSPECTOR, CHESAPEAKE AND OHIO RAILWAY, RICHMOND, VA.

One of the most important problems that has engaged the attention of man has been machinery. From the time of the building of the pyramids of Egypt until the present time, machinery in one form or another has been the essential agent of progress and achievement.

The operation of machinery will always be attended with some accidents but we can through education and safety devices eliminate the majority of them.

The wearing of loose and baggy clothing and the cramming of waste and paper in pockets of overalls should be prohibited.

Until recently manufacturers of machinery gave very little attention to safeguards. As a result, there are many machines now in use without proper protection. These machines can in many instances be made safe at a very little expense and the shop list of injuries materially decreased by the application of home-made safeguards. Another cause of injury is the defective hand tool. Tools should be inspected often and no tool be allowed to reach a workman that is in any way defective. Many flesh punctures are caused by flying particles from tools that should have been repaired and a majority of the eye injuries are from the same source. The investigation of eye injuries has shown that in nearly every case the man was not wearing goggles and it shows conclusively that this is still

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one of the problems the safety inspectors have to deal with. The careless use of the acetylene and electric welding outfits, the wearing of shoes that are worn thin or full of holes by men in foundries and blacksmith shops are sources of accidents.

The sprinkling hose, leaking valves and steam lines contribute their share to the list of injuries from burns and scalds. These injuries can be reduced to a minimum through proper supervision, strict attention to duty and a systematic application of the principles of safety.

CHAIRMAN CARROW: We are much indebted to Mr. Ganzert. It affords me great pleasure to introduce to you Mr. E. S. Chapin, of the Pennsylvania Railroad.

ELECTRIC CURRENTS, FALLS OF OBJECTS OR PERSONS

E. S. CHAPIN, SAFETY INSPECTOR, PENNSYLVANIA RAILROAD, PHILADELPHIA

I think we can learn from the figures given in Bulletin No. 74 some means of controlling the accidents, as illustrated by the figures shown therein.

Electrical accidents are the fewest in number, but the most likely to result fatally; therefore, we should be tremendously on our guard against them.

The following accidents were due to electric current:

	Killed	Injured
Shopmen	10	158
Stationmen		1
Trackmen	2	16
Bridge and building	3	9
Other industrial employees	7	39
All other persons	1	1
	23	224—247

We are impressed by the fact that this table shows a very high proportion of mortality, to the number injured—9.3 per cent of all injured resulting fatally, being over 5 per cent of all deaths in non-track accidents. On the other hand, the total number of accidents is the lowest under any of the general headings, being about twenty-six hundredths of one per cent. In other words, accidents from electric currents seldom occur, but when they do happen, are more likely to result fatally than those from other causes.

The current enters the plant at the switchboard, being generated in the power plant, or from some other outside source, and it is at this point we must begin our guarding.

A footing should be provided, made of wood, without the use of nails, or screws, or metal of any kind, with a beveled edge to prevent tripping, so that a man standing on the footboard will not be in contact with the floor. He should preferably wear shoes which do not have nails in them,

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as illustrated in the *National Safety News*, issue of October, 1921. In some places rubber, of a thickness of not less than a quarter of an inch may be used, but should not be placed in such positions where cuttings or chippings may be trodden into them; or where oil on the floor makes possible the deterioration of the fabric, unknown to the worker. The back of the board should be closed and locked, and the key kept in possession of the man authorized to do the work behind. When it is necessary to work on lines, there should be a safety block put on the switch, painted red, or locked in place some way so that it cannot be opened by any one other than the man doing the work.

In the use of rubber gloves around electrical apparatus, too much precaution cannot be taken, because the glove sometimes develops a hole, which cannot be found at the time. The Philadelphia Electric Company has developed a very careful test of rubber gloves, by immersing them in water; placing the gloves, with the fingers down, filling the gloves with a fluid and inserting into the top of the glove, an electrode; then testing the circuit with a galvanometer for a flow of current. By that method tests of gloves of their linemen are periodically made.

In going out to the plant, the distribution system should be carefully inspected when put up, to see that lines do not cross with other lines of heavier or different current; and all unintentional grounding carefully avoided. At the point of utilization on a machine the switch should be enclosed. In a great many cases switches can be closed by letting the handle protrude through the slot. I recommend the use of the standard safety switch approved by Underwriters' Laboratories, in which a man cannot come in contact with the blades of the switch when the cover is open, and where he can replace fuses if necessary, without danger. Many of these are provided with automatic locks—when the door is opened you have to have the switch opened. Some machines are operated by means of the push button.

The old hand will tell you that he can handle 250 volts with his bare hand. If he happens to stand in water, he gets a better contact than he expected; 110 volts have been known to kill a man when the contact was unusually good. We should always have the greatest respect for electric current.

I could say a great deal more, but I believe those examples give you a good idea how to proceed against such hazards.

COLLAPSE, FALL, ETC., OF OBJECTS

	Killed	Injured
Shopmen	15	7,755
Stationmen	3	865
Trackmen	6	830
Bridge and building men	10	443
Other industrial employees	8	643
All other persons	9	94
	51	10,630

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Here again we find that among the shopmen there is the largest number of killed and injured, but that the total number of fatalities was much less in proportion, being but forty-seven hundredths of one per cent. These injuries comprise 11.4 per cent of the total number of non-train accidents; showing that while they are common, they do not usually result fatally.

As causes of these accidents we find such things as piling materials; that is, placing the materials in piles, and having it fall during the process; or material falling upon workmen while removing it. Material falling from cars or engines may cause injuries and I might cite a method adopted by one of our engine houses to prevent material falling from the running-boards. Ordinarily, a man taking down side-boards, places the spare parts on the running boards; and some one else may come along and take down the running board, or kick some of the parts down upon the heads of workmen beneath. The plan adopted was to have all parts which were to be used again left on the floor; and those parts which were not to be used again were scrapped—placed at the outer end of the track door for collection by the scrap gang. This resulted in two things: first, that the objects were not placed above the heads of the workmen; second, that it was easier to collect the scrap.

Material stacked on the floor will sometimes fall down, at the passing of a train or heavy object; and this is particularly noticeable in the case of side, or main rods.

Material falling from the hands of workmen usually hits them on the feet; or, if there are two men carrying a heavy object, one man lets go, and the whole weight comes on the other fellow, usually with serious results. We have special trucks for handling heavy parts, such as, air pumps, tires, rods, axles, etc.

At our Indiana Harbor shop, a special truck for handling axles has been developed by our machine shop foreman, which enables one man to lift load, and unload the axle, without any exertion, other than that ordinarily expected of one man; and during the handling, he is out of danger, as the axle is loaded and unloaded on the side away from him.

Tools and materials being handled by cranes sometimes fall. Careful inspection should be made of all cranes and cables, in order to prevent accidents of this kind.

FALLS OF PERSONS IN INDUSTRIAL WORK

	Killed	Injured
Shopmen	27	5,283
Stationmen	3	1,030
Trackmen	17	1,661
Bridge and building men	17	719
Other industrial employees	25	1,178
All other persons	12	254
	101	10,125

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Here again, we find that the shopmen have 27 killed and 5,283 injured. One hundred and one fatalities are 22.2 per cent of the total number of fatalities due to non-train accidents; while the total number of injuries is 11 per cent of the total number of persons injured in non-train accidents.

Railings equipped with toe-boards, about all elevated platforms and working floors, to prevent men from slipping or materials from being pushed off, upon the heads of men below. The toe-board should be 6 inches high, placed just above the floor.

Floors should be kept in repair; particular attention being paid to holes in which men may catch their feet, or trucks be upset. Ladders should be equipped with safety feet to prevent slipping. Scaffolds should be carefully erected, and the trestles inspected.

Safety treads should be placed around wood-working machines. In the case of oily floors, when there is a chance of slipping, we have found it useful to take a double handful of slack lime; place it on the floor, ahead of the sweepers' broom. This does two things; cleans the floor, and makes the floor much whiter; cuts the grease, and affords a safe footing. In one of the shops, where we handle a good deal of greasy car equipment, the men kick unless the floor is white enough to see to pick up a three-quarters nut.

The condition of the shoes of the men, although a personal matter, enters into consideration. Holes in the yards, defective floors and footways need careful attention. During the winter, we have the hazard of ice and snow. The use of rubber shoes, or safety treads may help in combatting that hazard.

We have a number of injuries from pits being concealed or obscured by steam, or other dark conditions, which should not be allowed to exist. We should have sufficient lighting. Sometimes it is unavoidable to prevent steam from going across a pit and filling it. Lately a great many of the roads have been installing water ash pits. We have found that that involved a hazard, as well as an improvement, because the surface of the water becomes coated with ashes and looks like its surroundings.

CHAIRMAN CARROW: I take pleasure in introducing Mr. Astley, of the New Haven Railroad.

HANDLING RAILS, TIES, TIMBERS, ETC.

HARRY A. ASTLEY, SUPERINTENDENT, NEW YORK, NEW HAVEN AND HARTFORD RAILROAD, NEW HAVEN, CONN.

In addition to the gratifying results obtained through our safety committees, much has been accomplished to lessen accidents coming under the head of this subject, by the use of mechanical devices in the handling of rails, timbers, and other heavy material.

Statistics prove however that there is necessity for a continued effort or campaign of education to further reduce the number of casualties in this particular line of work.

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ABSTRACT FROM REPORT OF INTERSTATE COMMERCE COMMISSION ON HANDLING RAILS, TIES, BRIDGE TIMBERS, ETC.
CLASS I ROADS

Casualties

	1917		1918		1919		1920	
	Killed	Injured	Killed	Injured	Killed	Injured	Killed	Injured
Shopmen	....	2,200	1	1,933	1	1,431	....	1,445
Stationmen	....	148	1	181	1	153	....	202
Trackmen	5	9,089	7	6,927	8	7,149	6	7,890
Bridge and building	2	1,292	4	975	5	809	4	852
Other employees	1	516	2	342	6	340	2	413
All other persons	....	43	2	61	1	32	....	37
Total	8	13,288	17	10,419	22	9,914	12	10,839

Man Hours in Thousands

Shopmen	1,400,734	1,582,114	1,456,460	1,584,884
Stationmen	689,174	690,048	620,370	644,202
Trackmen	1,019,263	1,031,366	888,206	955,570
Bridge and building men	203,314	202,575	165,072	168,550
Other employees	415,005	418,927	391,372	410,764
Total	3,727,490	3,925,030	3,521,480	3,763,970

Casualties Per Million Man Hours

Shopmen	1.570	1.222	.983	.912
Stationmen	.215	.263	.248	.313
Trackmen	8.922	6.723	8.171	8.263
Bridge and building men	6.365	4.833	4.931	5.078
Other employees	1.246	.821	.884	1.010
Average	3.555	2.642	2.812	2.883

From the above figures it will be noted that most casualties per million man hours occur in the track department where the handling of the major portion of such material is performed largely by the cheapest paid labor and therefore the least intelligent, and it is an established fact that a certain amount of mental effort is required to avoid the unsafe practices which so easily creep into methods of doing work.

The principal causes for most of these accidents might be enumerated as follows:

Lack of united action where the handling of material requires two or more men.

Lack of understanding on the part of inexperienced men, some of whom may not understand the language used in the orders being given.

The non-use or improper use of tools in connection with this work.

Material improperly piled contributes to many injuries.

Inadequate storage space is also apt to result in rails, ties, timbers,

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etc., being piled too high; it is important that commodious storage room be maintained for various kinds of material, such yards to be kept in a neat and tidy condition.

Injuries to the hands and feet are frequent in gangs handling rails as well as other track material and care and competent supervision is called for when hand labor is employed in the moving of the heavy pattern of rails, frogs and switches used today, and without an experienced gang on such work, accidents are almost certain to follow.

The careless act of a green man frequently means an injury to a fellow workman, and it can be added that the thoughtless and careless factor contributes materially to the list of accidents reported.

The prevention of accidents rests to no small extent on the man in immediate charge of the work and one of the problems confronting the department of a railroad handling this class of labor is the difficulty of securing competent foremen, there being little incentive for a bright, intelligent young man to start at the bottom in order to perfect himself for the duties of a reliable foreman who can command the respect of his men, secure good results and strive for harmony and good feeling among them, which means so much in the elimination of casualties coming under this subject.

It is highly important that not only the foremen but the laborers be frequently instructed in safety work, perhaps to a greater extent than is now practiced, particularly the track and construction gangs who are not so readily reached as the shop men in the safety work as now carried on.

CHAIRMAN CARROW: The next speaker will be Mr. Pratt, of the Philadelphia and Reading.

HANDLING FREIGHT, SUPPLIES, MATERIALS, ETC.

J. T. PRATT, SUPERVISOR OF SAFETY, PHILADELPHIA AND READING RAILWAY COMPANY, READING, PA.

Accidents to stationmen during 1919, as per Bulletin No. 74, not including train accidents, show there were 18 killed and 11,217 injured. Of these, 9 killed and 7,300 injured were in handling freight or supplies and only 47 were injured handling explosives, inflammable or corrosive liquids, indicating that when proper attention is given to the red, white, green and yellow labels and markings on explosives, the accidents can be reduced to a minimum, and this also indicates the educational work being carried on by the Bureau of Explosives and their inspectors is producing good results.

Now, if we can convince the truckers and all station employees that it is just as important to prevent injury to employees as it is to get freight to destination in good shape and prevent freight claims, we will be accomplishing results.

There are many conditions that enter into the cause of accidents, namely:

Platforms: condition, whether kept clear of all obstructions, smooth so

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trucks will run without shaking the commodities off, that platforms are as near the same level as car floor as possible, so bridges will be less liable to slip.

The condition of these bridges and the method of fastening them to prevent slipping: some have iron plate bent along one edge about 6 inches back, this causes plate to rest on two edges and helps hold to floor of car and platform.

Others use wooden planks with heavy cleats running crosswise, that prevent slipping towards car or towards platform. Others have short heavy nails that go through holes in corners of iron bridge into car floor and are pulled out by lifting plates up.

There are too many accidents caused by plate iron bridges slipping. Cleats nailed to floor of car or on platform obstruct the wheels of trucks, tractors, and trailers. If in the middle the three wheeled tractor bumps it, if on the corner, the two and four wheeled trucks catch them.

Condition and kind of tools also enter into the cause of accidents. Condition of trucks and trailers, lighting and weather conditions also play a part, as well as the physical condition of the men.

Pushing or pulling the trucks also appears to enter into the accidents, as when men pull the trucks and they slip off iron bridges it sometimes catches their feet. This would not occur if men would push trucks, and could see when bridges slip and truck or load is going to fall. Men do not realize the danger of freight falling on their hands or feet.

PACKAGES AND CONTAINERS A LARGE ACCIDENT FACTOR

Records appear to indicate 25 per cent of the injuries are caused by falling packages, either when stowing in cars, or falling from trucks. About 9 per cent are strains and ruptures, due to the lifting or pushing. There are times that persons will strain themselves when lifting a small weight, due to the awkward position in which they are standing.

The condition of the packages also enters into the accidents to a large extent. Many nails are not driven in straight and the points extend out and catch hands, clothing or other pieces of freight. There is a great improvement in the condition of boxes and barrels, but the strap iron and wires used in holding boxes or bundles together often cut men's hands badly. A good container properly handled, decreases accidents and claims and produces satisfied patrons, while a poor container produces just the opposite and it takes longer to handle it.

Containers for explosives and other dangerous articles must be kept up to the standard and if shipments are offered which are not up to the standard, the carrier is liable to a fine for accepting it: therefore the small number of injuries to employees, 47 as against 7,300 for other commodities. Of these few injuries in handling the dangerous articles, 34 per cent were due to handling acid, and 29 per cent due to handling gasoline. The acid injuries are principally due to improper handling of the supposedly empty carboys, which contain some acid, and the men turn them upside down or on their sides, and spill the small quantity of acid out on their hands or splash it on their faces by rough handling.

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This would not occur if the receiving clerk would enforce the law and see that stoppers are well secured.

The 29 per cent of gasoline injuries were generally caused by some thoughtlessness, such as striking a match, which caused the vapors to become ignited, or bringing lanterns or torches into cars, causing fires and severe burns. There were no injuries in the handling of shipments of explosives during 1919 at transfers. There was one trucker injured by placing a blasting cap that he found in a carload of wire, on a rail and exploding it with a hammer (Annual Report, Bureau of Explosives No. 13). This further emphasizes the necessity for more education of the individual to be careful and stop taking chances.

CHAIRMAN CARROW: Before I turn the chair over to Mr. Hale to conclude the session, I want to thank every one of you. We have had a great meeting, and I thank you sincerely, from the bottom of my heart.

CHAIRMAN HALE: In connection with that last paper, if some of you fellows who have some large freight terminals on your minds get your pencils working, you will be able to use them to good advantage. A Kansas City freight house, working an average of 165 men every day, handled a volume of business totalling eighteen million pounds, which is equivalent to handling ninety carloads of L. C. L. freight every day, and kept it up for a period of one hundred and twenty days, without pinching a man's finger or injuring a man in any way—a period of four months without an injury reportable, even of the slightest character. I doubt if it has been equaled anywhere in the world. You can use this among your freight house foremen. They will use the argument: "If birds can fly, why can't I." Your people can do it.

I know of no other business to come before the meeting and will entertain a motion to adjourn.

MR. M. A. DOW: I would offer a motion that we have certainly enjoyed these sessions—they have been most helpful and instructive. I feel that they have been in a measure due to the competent and efficient way in which the chair has been handled during the meetings; and I feel that we owe Mr. Carrow a debt of gratitude; inasmuch as he has conducted these meetings without talking too much. I therefore move we offer the retiring chairman a vote of thanks for the efficient service given while in the chair.

CHAIRMAN HALE: You have heard the motion. All in favor say, "aye". Contrary minded? The motion is carried.

MR. GEORGE WRIGHT: Before we adjourn, I move we offer a vote of thanks for the very able manner in which the program was gotten up.

CHAIRMAN HALE: It is well taken. All in favor of that signify by saying, "aye". Contrary minded? It is a vote.

ADJOURNMENT.

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Textile Section

September 27, 28, 1921

D. H. STOWELL, Chairman
Pacific Mills, Lawrence, Mass.

A. E. CONRATH, Vice-Chairman
International Harvester Company, St. Paul, Minn.

A. F. KING, Secretary
H. A. Hale, Jr., and Company, Boston

TUESDAY MORNING SESSION.

THE meeting was called to order by Chairman Stowell. The reports of officers were presented and accepted. The chairman appointed Messrs. Hitchcock and Ingham as members of the nominating commitee.

THE TEXTILE SAFETY CODE

THOMAS B. HITCHCOCK, AMERICAN MUTUAL LIABILITY INSURANCE COMPANY, BOSTON

Some of you probably wonder what is in store for you should a safety code be formulated by the Textile Section of the Council. I therefore would like to expain at some length what may be in store for you if we do *not* formulate such a code. The assistance of yourselves and of your textile associates is so desirable for the success of the work that this is intended as an appeal for your wholehearted cooperation.

The general purpose of any safety code is to classify the fundamental principles which govern the avoidance of accidents. It deals with questions of design, with installation or erection as in the case of boilers or elevators, the correct practice in operating, the character and application of safeguards, plant conditions, and the like, and establishes well-defined standards that should be observed.

The public is already subjected to many codes, especially those developed by states and municipalities and containing mandatory features of which we are constatly being reminded.

In addition to this local supervision, the manufacturer who engages in

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interstate commerce may find his product shut out of one state, although admited for sale in the other forty-seven, because that particular state has a pure fabric law with which it is not worth his while to attempt compliance.

In the same way a machine builder must frequently adapt his patterns to the special requirements of the state into which his product is going; otherwise it would not be in strict agreement with the specifications of the particular code of that state. Before the uniform Boiler Code was generaly adopted, large plants stretching across the boundary between Pennsylvania and Ohio were sometimes unable to operate the same type of boiler in different parts of the yard without violating the laws of one of those states.

This lack of harmony exists not only between states but also between authorities in the same state. In Pennsylvania the state insurance department standards differ from those of the department of labor. Here we have two agencies of the same state making inspections under different standards.

So far the state regulations that affect the textile manufacturer deal chiefly with conditions common to manufacturing in general, but there are frequently instances of different interpretations made by successive inspectors, so that changes made at the behest of one are condemned by the next man who comes along.

You find confusing or impracticable suggestions in various booklets which treat of textile hazards; recommendations made by insurance inspectors have been known to be of somewhat similar character.

If we are to have a code, why not have a reliable one? Would you not rather help in writing the law than leave it to the professional code writers in the labor departments or industrial commissions of the states?

The realization that the textile industries may some day be confronted with conflicting formal codes is responsible for the present effort to get united and harmonious action. The state of Pennsylvania actually has a textile code in preparation and other states will eventually do likewise unless the work is done for them by some representative body of men and in an acceptable manner.

We feel that we have here the proper nucleus for this work, for this Textile Section of the National Safety Council gets its authority from a body that is recognized throughout the country as a suitable directing agent.

Many of the technical societies have been notably active in working up codes for the guidance of their members, such as that for boilers put out by the A. S. M. E. But they early sensed the need of closer cooperation in order to prevent duplication and the promulgation of conflicting standards. According to the 1920 annual report of the American Engineering Standards Committee, when that committee was formed in 1918 there were more than 100 organizations publishing engineering standards, most of which were formulated with little regard to harmonious cooperation among the organizations interested.

It was evident that some central body, if supported by sufficient authority, could do much in directing this work and acting as a bureau

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of information regarding standardization. Accordingly five of the big national engineering societies formed a joint committee which became the A. E. S. C. or American Engineering Standards Committee, with three members from each of the five parent societies. This has been increased from time to time so that it now represents 17 societies or groups, including the National Safety Council and five government departments, among which is the Bureau of Standards.

The A. E. S. C., generally called the Main Committee, is (to quote the above mentioned report) "solely an administrative and policy forming body and does not concern itself with technical details. Each industry, or branch of industry, is wholly autonomous in its standardization work, the function of the main committee being merely" (and this is most important) "to assure that each body or group concerned shall have opportunity to participate in its formulation, which is in the hands of a working committee, technically called a 'sectional committee', made up of representatives designated by the various bodies interested together with other specially qualified individuals. The Main Committee must approve the personnel of each sectional committee as being authoritative and adequately representative of the various interests concerned."

The Main Committee names as "sponsor" some appropriate organization (not necessarily a member) to take charge of the work, two or even more such bodies may be joint sponsors for the same work. The sponsor then organizes a Sectional Committee which must be approved by the Main Committee if its findings are to have any standing in engineering circles.

As a matter of common sense procedure this Section Committee calls to its assistance other organizations that are in any way concerned with the work in hand and either adds to its membership, representatives of such bodies or consults them in an advisory capacity.

From the foregoing it is evident that no one group of people can control the formulation of a code; if this were possible, not only the Main Committee but the several bodies from which it receives its credentials would be thereby discredited.

With special reference to the Textile Safety Code, two bodies were approved as sponsors—The National Association of Mutual Casualty Companies and the National Safety Council. The former is not a member of the A. E. S. C., but its interest in the subject is sufficiently great to give it a leading part.

The two sponsors formed a joint committee a year ago, those to represent the Council being named by the Textile Section. The unfavorable business conditions of the past twelve months, however, have discouraged more than one attempt to get so large a body of men together, but some of the Council representatives have met and discussed plans for proceeding with the work.

It is proposed to form a much larger committee, composed of representatives from all organizations that may be in any way concerned in textile manufacturing and can be induced to take part.

Aside from the several associations whose members are active manufacturers of cotton, wool, worsted, silk, jute, etc., any organization that

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has a textile section should be represented; the Textile Section of the A. S. M. E. has promised its cooperation. So has the Bureau of Standards. Others that deserve representation are the state industrial commissions, and the National Workmens Compensation Service Bureau.

As to other bodies that might be eligible the committee is particuarly anxious to receive your suggestions, and, above all, asks you men here, who belong to such organizations as the National Association of Cotton Manufacturers and that of Wool Manufacturers, to agitate the question among your fellow-members so that their assistance may be forthcoming. (Instead of a single delegate from these manufacturing associations it might be better to have a large number.)

It is not to be expected that a group so large as this may prove to be, can get together and work as a whole. It must be borne in mind, however, that each of the several textile branches must be covered for the most part as distinct propositions, and handled by sub-committees drawn largely from their respective lines. A further breaking up of these sub-committees into groups of three or five may be desirable to study the problems that concern solely pickers, cards, etc. Finishing, with its great variety of equipment, will be no simple problem.

To consider all these in proper detail it is plain that the committee must have behind it a large body of men, experienced in varied lines, who can be drafted for the work. A group so constituted will avoid such ambiguity as appears in that familiar little "Hand Book of Industrial Safety Standards" in describing how the point of operation of a card should be protected by an interlocking door. You cotton men who have equipped your revolving flat cards with improved stripping appliances which eliminate the hazard of stripping, now receive no credit for it.

An interlocking device is all right in its place, but should it be recommended for cards that are stripped in the old way? Will you ask that an interlock be made standard equipment for your lappers, or for the differential section of your roving frames?

After you have protected the headstock of your mules, and have guarded the wheels and certain bands and sheaves, can you reasonably be expected to do more?

How about the gears on your worsted gill boxes? If they cannot be completely covered in without seriously hindering their operation, what degree of protection do you think should be established as standard?

It is for the composite committee, combining the extensive records which only insurance companies can supply with knowledge and operating experience of mill men, to decide points like these.

Whether or not a code, drawn by such a body as you can help gather, will be generally adopted by state labor boards is for the future to decide, but the chances for wide acceptance are good; most of them are waiting to see what is done.

It will be so drawn, however, that proper differentiation will appear between requirements and simple recommendations and the correct phraseology used to permit eventual legislative enactment.

Is it not well worth your while, in view of legislative tendencies, to have a hand in formulating standards that concern you so vitally?

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SAFETY ENGINEERING IN THE TEXTILE PLANT

EVERETT F. KING, H. A. HALE, JR., AND COMPANY, BOSTON

From our own tabulation we find that in the course of a year, 22 per cent of the accidents in a large worsted mill were due to moving machinery, and the remaining 78 per cent to non-mechanical causes. Falls from slippery floors, due to oil or water, falls down stairs and falling over material caused 11.7 per cent of these accidents.

Handling material (12 per cent), falling material (10 per cent), striking objects (8 per cent), strains (8 per cent), and infections (3 per cent) are the other chief causes.

UNSAFE CAUSES

The Safety Engineer must carry on a permanent drive against one particular type of accidents—those due to unsafe practices. Cleaning machinery in motion heads this group, and if this can be stopped, the number of accidents from mechanical causes will drop over 25 per cent.

There seems to be a certain attraction about a piece of waste or other material which has lapped around a shaft, that tempts one to pull it off while the machine is in motion. Of course the lap should not be there, and it is only natural to try to remove it. If one has been trained in safety so it instinctively becomes a part of one's conduct performed unconsciously, the machine will first be stopped before it is cleaned or the lap removed. Otherwise, an accident will eventually occur.

All machines can be stopped for cleaning purposes in a textile mill with but one exception, namely in the card room. If the cards were stopped before cleaning it has been estimated production would drop 12 per cent.

The machines that are cleaned most while in motion, with an accident as a result, are the gill boxes. One trouble with these machines, and other textile machinery, as far as safety is concerned, is that they do not come fully guarded; the gears are covered on the outside, but not on the inside. The manufacturers of these machines and other textile machinery could assist appreciably in preventing accidents by building better guards and I believe the Textile Section, through its standardization committee, can do good work in obtaining the cooperation of textile machinery manufacturers. It should not be necessary for a textile plant to build guards for its new machinery, that should come into the plant fully protected.

Combing hair near moving machinery is another unsafe practice, which, however, does not occur as frequently at present, I am happy to state, as in former years. Through the efforts of the overseers, second and section hands, the girls have gradually become convinced of the great danger of this practice.

About ten per cent of all lost time cases are caused by infections, a large number of which occur in the spinning department from small cuts or scratches or from slivers. Some mills find it desirable to have a first aid worker in each department, under the supervision of the nurse,

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to take care of these small injuries, eliminating a trip to the first aid room. This saves considerable time for the employee, which is most important if working on a piece-rate, and the nurse is quite a distance from the department.

Other plants consider it better practice to send all cases to the nurse, even the slightest injury. Preference for either method depends largely on the size and lay-out of the plant. The task at hand is to get all employees to cooperate by reporting the most trivial injuries.

A large number of accidents occur from handling material carelessly. Handling trucks, beams, and warps without using due care accounts for about ten per cent of the lost time cases, which can only be eliminated through the cooperation and education of the employees.

FALLS

One of the most difficult problems the Safety Engineer in a textile mill has to solve is to prevent employees from falling. Constant attention should be paid to see that the oilers do not oil in a careless manner, getting most of the oil on the floor instead of on the bearing.

To prevent slipping on wet floors, three precautions can be taken. First, the scrubbers should be instructed not to use too much soap and to wash the aisles, where possible, in such a manner that one-half of the aisle is dry and open for traffic.

Second, a powder should be used that will leave the surface of the floor without that slippery film usually present when ordinary soap is used. There are a number of these scouring agents on the market.

Third, if possible and practical, scrubbing the main aisles should be carried on by a separate crew at night. This system was used by a textile mill and a noticeable drop in accidents from slippery floors resulted, because during the day the main aisles were always dry. Scrubbing machines were used at night, each department being scrubbed at different periods. This work, although it gives excellent results, proved quite expensive for the same number of scrub women had to be employed during the day to cover the toilets and out-of-the-way places.

There is one building, four stories high, with 500 girls on the fourth floor and 300 on the third, where falls used to occur on the stairs when the employees were leaving the mill, although the stairways were in perfect condition and equipped with safety treads. These accidents were caused by crowding and pushing. We installed fire drills in this building and now the fire drill formations are used every noon and night, the employees leaving in order by twos, with stairguards stationed on each stairway and at each door. As a result, our accidents from falls on stairways disappeared and the employees in this building leave in about one-half the time formerly required.

SAFETY ORGANIZATION AND EDUCATION

It is evident that the accidents due to unsafe practices cannot be entirely prevented by the Safety Engineer in recommending physical safeguards, for these accidents are due to the absence of the spirit of

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safety, to carelessness or the lack of judgment. He must take means to educate the entire working force, to teach the employees how to work safely and to train them to do what they know is right and safe.

All types of men must be reached from the foreigner who speaks little or no English to the worker who, although intelligent, is inclined to be naturally careless. Not only must the new worker be watched, but also the older employee who, because he is familiar with his work, having been in the service for a long time, and perhaps never injured, tends to become indifferent to the danger that exists on his machine.

The Safety Engineer can never put his message across by working alone; he must obtain the interest and cooperation of everyone in the plant from the Agent down. The safety organization as shown at previous section meetings should have representatives in it from each department serving on the workers' committees. The overseers should have their safety committees, and the agent and superintendents should make up the General Committee. Assuming the co-operation of every overseer, the most important part of the organization is the workers' committees, upon whom the Safety Engineer must depend in order to get the atmosphere of Safety into the plant.

It is at their meetings that he must sell the safety idea, showing them how the accidents occur from unsafe practices and carelessness, how they can be prevented, and enlisting their co-operation to make suggestions. He must make them realize that the Safety Organization has an important bearing on their own personal welfare, and without their sincere co-operation, accident prevention work will not be successful. With the rotation of the personnel of the workers' committees, he will gradually have safety boosters working for him throughout the plant, and eventually the safety atmosphere will permeate through all departments.

Section hands should be included in the personnel of the workers' committees, for they are in an ideal position to gain the confidence of the people working with them. The overseers are too busy to carry on safety education along with their other duties, but the section hands are so close to the workers that they can easily observe whether they perform their duties in a safe manner. When the section hand corrects the unsafe methods of the new employees, or older ones if necessary, he should be tactful, giving his advice in a friendly or sympathetic way so that no antagonism will result.

BULLETINS

Just a word or two regarding bulletins. An employee injured through his carelessness, or negligence, becomes a strong booster for safety, for he has learned his lesson from his own experience. The rest of the employees can benefit by his experience also, and much suffering will be eliminated, if the story of his accident is published. This is best done by a bulletin posted in every department throughout the mill, unless the type of accident affects only one department, then a special bulletin should be devised.

The bulletin should include a photograph illustrating just how the accident occurred, along with a short explanation, and finally how the

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accident could have been prevented. If possible the injured's name and department should also be included. A bulletin of this type brings Safety home to the workers, because they realize the accident occured in the plant where they are working and naturally more interest will be aroused in this way.

Every type of accident should be used as an example; chance-taking, cleaning machinery in motion, falls, elevator accidents, careless handling of material, and infections.

In order to inform every one in the plant just what progress is being made in preventing accidents a quarterly report should be published on the bulletin boards, showing a comparison with the same quarter the year before or with the previous quarter in the same year. It is most advisable to publish this information in the form of simple charts.

One of the important traits in human nature that can be capitalized to advantage in safety work is the desire of the individul to excel. Different sections or departments of the plan should be matched against each other in accident prevention. A monthly bulletin showing the result of the competition indicating the standing of each department will keep alive the interest of the employees.

GUARDING

Although mechanical accidents cause only 22 per cent of the total accidents, they are by far the most serious and cause most of the time lost. Consequently if this type of accident can be decreased, a big reduction in days lost will follow. This can be done through education of the employee as mentioned above, and secondly, by making the machines as safe and as fool-proof as possible.

Every lost time accident in the plant, due to mechanical causes, should be thoroughly investigated by the Safety Engineer and if possible a guard should be installed that will prevent a similar accident. It is a fairly simple matter to cover a gear, but there are certain departments in a worsted mill where it is possible for an accident to occur, and where a guard may interfere with the work. For instance, in the card room a guard covering the side-belts of a worsted card is not practical. Such a guard made of perforated metal, was given trial, but due to the large amount of flying material about a worsted card, it soon became covered with this dust. The men objected to the guard because they could not clean with it on, or oil in a satisfactory manner. It was in the way, so was removed and discarded.

I have also in mind three other departments, the slasher room, the decatizing department and the dry-can room. These departments may not all be familiar to you, but all the operations have to do with the winding of cloth between two rolls. In the slasher room, a guard between the rolls was not practical, so we extended a bar across the machine whereby it could be instantly stopped. Before the guard was installed it was necessary for the operator to walk to the side of the machine, which is 7 feet wide, to reach the shifter. This would not have been possible if his hand had been caught between the rolls.

In the decatizing department, we had a different problem. In rolling

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the cloth, it is important that no wrinkles be present, and for that reason the operator smoothes the cloth with his hands if the cloth does wrinkle, just before it reaches the point of contact between the rolls. We first thought a simple bar could be placed between the rolls guarding the point of operation, but as one roll builds up it forces the other out on a carriage, so a stationary bar could not be used. We are working on a bar that is raised with the roll which builds up, and that can be lifted out of the way by the operator when it is necessary to cut the cloth, the bar falling back into place after this operation is performed. This will be left on trial for a few weeks in order to find out its faults, if any.

On the dry-cans, we were able to use a simple pipe-bar between the rolls, which is working very satisfactorily. The installation of guards is a paying investment; if they are built right and do not interefere with the work, they not only reduce accidents but they raise the morale of the whole working force. Good guards show that the company is in earnest regarding accident prevention, and they further the workers' respect for and interest in safety.

(Mr. King then showed lantern slides of home-made bulletins and guarded machinery.)

DISCUSSION

Mr. Allstein: If you gentlemen have any information on loom guards I shall be very glad to receive it.

Chairman Stowell: My experience has been it is a waste of time to try to guard an old loom. It can't be done without going to an expense that is almost equal to buying a new loom. The only thing that can be done is to guard the most important gears.

Mr. King: The biggest difficulty we have had at the Arlington Mills has been to provide a satisfactory shuttle guard on looms to prevent employees getting hit by flying shuttles. We had one guard installed, but it was too complicated and didn't stand up under vibration.

The shuttle when it flies never hits the operator of the loom out of which it flies, but hits the alley mate. So at the American Woolen Company we tried putting screens between the looms, but these are not entirely satisfactory because they catch the dirt.

The biggest gears uncovered on the old looms are the gears on the upright shafts and we have to cover those completely. That is about the only gear on the loom where we have any trouble.

Mr. H. W. Donald (American Mutual Liability Insurance Company): One large plant I visited had gone over their looms to avoid shuttle accidents by resetting the lay. They found the least irregularity in the lay would cause the shuttle to fly out and by takiing them apart and getting new castings and new woodwork they almost completely did away with the shuttle flying out.

Another textile mill had a report sent to the safety engineer whenever there was a flying shuttle accident. Then they immediately went to the loom and made an adjustment. They found that this eliminated accidents.

Chairman Stowell: My experience has been that an operator almost never is injured on the gears of a loom. Has anybody had experience with such accidents?

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MR. ALLSTEIN: Operators have lost the tips of their fingers on the double pinion that operates the head motion of the gears. We have partially eliminated the shuttle flying problem by staggering the looms. When the shuttle flies, instead of going into the alley of the next loom it goes into the loom itself.

MR. H. L. ROBINSON (Crompton and Knowles Loom Works, Worcester): Most of the looms that we are putting out now are guarded. On the take-up gears we don't think a guard is necessary because even on a very fine pick they move so slowly that there is very little danger of men getting caught. I haven't heard of any accidents of that kind. We guard all of our driving gears. We are putting a shuttle guard on our looms which is merely a heavy wire on the lathe. The shuttles may still fly through the end. Some of the mills in Worcester have a wire on the end and that has cut down the hazard very effectively. It is impossible to make a shuttle guard to cover the end unless you put on a screen or something like that.

GUARDING CARDS

MR. C. F. WOLF (Travelers Insurance Company, Hartford, Conn.): Only a short time ago I saw a picture of some card guards in Philadelphia, made out of sheet metal. They have been there for a number of years and it is just as easy to clean the guards as it was the floor. So why isn't it practical to have a sheet metal guard at the side of the cards?

CHAIRMAN STOWELL: In my own plant all cards, both cotton and worsted, are completely guarded with sheet metal guards. These do not enclose the side belts.

MR. WOLF: These guards that I speak of were made in sections about four or five feet long so if any repairs or cleaning had to be done the entire section could be taken out and laid aside. When the guard was in place it offered complete protection.

MR. HITCHCOCK: That works out all right in an exposed alley, but when you get between the guards it is different.

MR. SYDNEY INGHAM (Ludlow Manufacturing Association, Ludlow, Mass.): After experimenting we put one guard on. Our cards are very high speed machines and have to be oiled frequently, and we found that to lubricate our bearings it was necessary to put about sixteen doors on the guard. The more we went into it the less we liked the idea and we finally gave up guarding the belt side of our cards.

MR. KING: The French manufacturers protect the side belts with a small piece of cast iron covering the point of contact between the belt and the pulley. But, of course, you still have the hazard of a man getting his arm caught by the belt and striking the guard.

MR. BROWNELL: In one finishing mill I noticed a very bad gear hazard on the print machine. I was told that many men had devoted a great deal of study to the guarding of those gears and I am extremely anxious to know if anyone has solved that problem.

CHAIRMAN STOWELL: I have never discovered anybody yet who has designed a successful guard for the printing machine—that is, the old printing machine as it was built a good many years ago. A new machine can be built so as to eliminate this hazard.

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KEEPING UP INTEREST IN SAFETY COMMITTEES

MR. JOHN R. BROWNELL (Equitable Life Assurance Company, New York): I would like to ask for the experience of those having to do with the organization and development of safety committees—whether it has been possible to maintain interest. Also, whether they have had experience in the use of rotating inspection committees through different mills and different departments.

MR. KING: As time goes on more interest is being shown. The organization has been running for about two years and at the present time due to rotation of personnel of the workers' committees we have about 250 past and present members in the plant. Each member on being retired is given a retiring safety button and active members have a different type of button. We recently conducted a Safety Contest in the mill. Yesterday we had a rally and the three prize winners were given five dollars apiece for the best songs. Then we had two of the employees sing their songs. We had 2,000 at the safety rally so you can imagine how much interest is being taken.

I find that the workers have a very active interest in the organization because they feel that the company is doing something for them and they feel that everybody is given a direct interest and, of course, that not only prevents accidents but it increases the morale of the working force.

Each department has a member on the Workers' Committee. Our officers meet twice a month, our workers' committee meets twice a month, and the general committee of the agents and superintendents meets once a month. The suggestions of the workers are taken up with the officers and a report is made to the workers' committee showing what action has been taken. Our committees range in size from twenty to thirty.

MR. BROWNELL: Do they make any inspections of other departments rather than their floor?

MR. KING: Yes. Thus every committee man working in a building becomes familiar with the hazards in the other departments. Due to the size of the mill we have to have an inspection committee in each building because the buildings are very large. The committees are appointed by the officers.

COMMITTEEMEN ASK FOR LONGER TERMS

CHAIRMAN STOWELL: We have had an organization about two years and a half. At first the term was three months, one-third of the members being appointed each month. Recently after the committee had been running all that time the interest has been so great that the members asked to have the term increased to six months, which was done. Also when the papers began to publish notices about this convention some of the former members of the committee asked if they couldn't get together and talk over these safety matters as a sort of an alumni association of the committee itself which probably will be done later. Sometimes you get some committees which are dead or almost dead because there are a few members who are not interested. With us in practically every department the employees elect their own representatives on the committee; that has added to the interest a great deal.

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Every overseer in the plant is a member of his particular department committee and it is part of his work to attend the meetings every two weeks. The principal factor in keeping down accidents is the overseer. through his section hand. That is the reason why we keep them permanently on the committees.

In a little more than two years the committees have submitted something like two thousand recommendations and very few have had to be disapproved—probably not more than fifty out of two thousand. Every recommendation made by a committee is either approved and acted upon. or the reason for disapproval is sent back to the committee.

MR. MERRILL: We have a workmen's committee in each of our five plants. On each committee is one workman from each department. The committees meet monthly. In charge of each committee is the safety chairman for that plant. In three of the plants he is the assistant master mechanic; in one, the employment man, and in the smaller plant one of the section hands. I attend these meetings each month. Recommendations are made, following inspection by certain members of the committee in rotation, and immediate action is taken by the committee on the majority of them. Anything that is too big to be handled in that way goes up to the management. The committee has now been running for about a year, and we have passed over a thousand recommendations in all the plants and have already completed about 80 per cent of them.

When a man completes his term on the committee he is given a diploma signed by the manager of that plant. While he is serving on a committee he has a pin which designates him as a committeeman.

ADJOURNMENT.

WEDNESDAY MORNING SESSION

CHAIRMAN STOWELL called the meeting to order.

ACCIDENT HAZARDS IN THE TEXTILE INDUSTRIES AND WAYS OF MEETING THEM

SYDNEY INGHAM, SAFETY ENGINEER, LUDLOW MANUFACTURING ASSOCIATION, LUDLOW, MASS.

The Ludlow Manufacturing Associates with whom I work for the prevention of accidents are engaged in the manufacture of jute products. carpet yarns, twine, marlines, webbing, bagging for covering cotton, union cloth, and some hemp twines and marlines. They employ about 3,500 people under normal conditions.

The first process in jute manufacturing is the opening of bales. This is done by cutting the binding rope. The bales are then opened and softened. During these processes and while the fibre is in a dry condition a considerable quantity of dust is shaken out, much of it being of a gritty nature and consisting largely of fine particles of sand and mud in which the plant grows. It is in this dust that tetanus spoors have been found.

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It is our practice, when treating injuries which may have been exposed to this dust, to inject a shot of anti-tetanus serum into the patient. It is interesting to note that we have never had a case of tetanus develop, but in Dundee, Scotland, where most of the European jute mills are located, a number of cases have been reported.

Our first problems are non-mechanical accidents—falls, falling material, hand labor, slivers, and infections. To prevent falls, we have concrete walks in our yards, maintained in the very best condition; wide stairways with anti-slip treads, hand rails, and well lighted, without glare; ladders with hooks and safety feet; platforms and runways guarded by rails and toe boards. Yet in spite of these precautions several of our people fall and lose time every year. By visiting these people I find that they are lame, that they do not see well, that high heels cause falls, that they do not use hand rails, and that sometimes there is scuffling and pushing on the stairways as the workers go out or enter the mills.

If an operative is lame he is allowed to go to the yard door in advance of the others. If he cannot see well he is urged to be fitted for proper glasses. If shoes are not right, common sense shoes are advocated. If rails are not used the worker is taught the value of hand rails. If there is scuffling the guilty party is laid off for a week or so.

To prevent accidents from falling material we teach our workers to be very careful about piling stock; our mechanical and electrical men are instructed individually about not leaving tools and equipment where it may fall or be pushed onto a passer-by.

One of our big problems has been slivers from boxes and bobbins. We found our doffers using bobbins as knockers to loosen flyers on spinning frames, which splintered the bobbin. By stopping this practice and by care in the selection of stock for our bobbins and boxes we have reduced our sliver accidents from 11 per cent of our accidents a year ago to 2.3 per cent in seven months of this year.

We have reduced frequency from infections 80 per cent by careful educational work and an insistence upon workers reporting for first aid treatment all cuts and abrasions no matter how trifling.

When a person is employed in our company a card like this (showing card) is made out for him and if he is injured in the future it becomes his accident record.

STARTING THE NEW MAN RIGHT

Two or three days after the new worker is on the job I go out into the mill and talk with him about his machine and its hazards, about safety in general, and about the importance of reporting minor injuries and receiving first aid treatment. Then I have him sign the card acknowledging that he understands the safety rules and machine instructions. About a month later the card goes back to the overseer in the department and he certifies on the card that the operative is familiar with and practices safe methods while engaged in the work described.

We have ninety bulletin boards in our plant; at least one in every department. We publish our own bulletins, also using some published by the National Safety Council and by our insurance company. Here are a few samples of our own bulletins.

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I believe that the primary purpose of a bulletin board should be to teach workers to think and work in co-operative fashion.

In most textile plants the type of employee in the majority is a very fertile soil for the influence of good or evil. With relation to this influence the bulletin board represents a large, potential and unrealized value. It is capable of development until it becomes a positive, daily educational influence. Its limitations are bounded only by the skill, thought, interest and effort devoted to making the board interesting and informative.

One side of the bulletin board holds accident and health bulletins, the other side is used for general interest, plant and departmental bulletins.

Every month a chart and an analysis showing the number of lost time accidents, the amount of lost time, and a comparison between that month and the corresponding month of the year before is sent out to all mill superintendents, with a description of the more serious accidents and recommendations to prevent repetition—also a classification of minor accidents, by departments and by causes.

We have a safety committee made up of representatives of the various mill groups a representative of the mechanical and electrical departments, and one of the yard and transportation departments, holding office for six months; our plant fire chief and myself are the only permanent members.

Each month we meet to discuss the proceedings of the last meeting the recommendations made and the disposition made of them by the management. We talk over any practice or condition that has been observed since the last meeting and make recommendations relative to them and finally we go on a trip of inspection through one of the mills the shop or the yard. We do not follow any regular order of inspection so that the mill superintendents do not know when we will inspect their mills.

The reports are sent to the management and all mill superintendents and are discussed at the next executive conference, and action is ordered or the recommendations may be turned down. In the latter case the person who made the recommendation is told why it is not considered advisable to follow the suggestion. No recommendation is ever turned down in silence.

Several of our employees are boys and girls under sixteen years of age. These children attend continuation school. Last year, with the kind co-operation of the continuation school teachers and the local superintendent, I was able to interest these youngsters in safety by introducing a series of contests. At least once a month I went to the school and talked to the boys and girls about the work in their departments, and then invited questions. I learned about more unsafe practices in the mills from these youngsters, in our talks, than I could possibly have picked up from observation in several years. That the children took a healthy interest in Safety Work is evidenced by the responses we received to a request for a short essay on any one of five safety subjects assigned. Eighty-seven per cent of the school submitted papers the first time and 97 per cent the second time.

These papers were so good that they were submitted to the manage-

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ment of our plant and some thirty points brought out by our boys and girls were discussed and acted upon at our executive conference.

(Mr. Ingham then read the company's rules regarding safe operation of machinery. Space permits only an abstract of the more important rules to be given here.)

SAFETY RULES

Elevators. Usual rules regarding safe operation and prohibiting operation by unauthorized persons.

Card Cleaning Procedure. 1. Main card belt is shifted from tight to loose pulley by the gang boss who drops a pin which he carries with him into the shipper or attaches a specially designed lock so that belt will not be replaced on the tight pulley by anyone but himself.

2. Gang boss sees to it that covers are not removed or card touched in any way until cylinders have come to a full stop.

3. Stripper belt is removed as well as driving chain on workers.

4. Gang boss, when organized gang does the picking, takes no part in actual work other than to assist and see to it that all men are kept busy.

5. Card covers are replaced.

6. Gang boss ascertains that everything is ready for starting and then shifts belt to tight pulley.

In the bagging card room it is necessary to have the card in slow motion during the cleaning process; therefore the above procedure is varied by placing upon the gang boss the duty of cautiously shifting the belt from loose to tight pulley and not permitting the speed to exceed 25 R. P. M.

Doffer Roll Cleaning (Except Bagging). Similar to bagging card cleaning. Room overseers will require use of approved type of card-cleaning rakes and hooks and forbid all members of card-cleaning gangs wearing loose or torn clothing which may endanger their safety. Sleeves will always be either cut off or rolled up.

Bagging Rolling Machine. This is a special one and very hazardous if handled by an unskilled workman; therefore only the machine operator is permitted to start the machine.

Penalties for violation of these rules are, in general, a severe reprimand for the first offense and a lay-off or permanent discharge for repeated offenses.

Electrical Department—Usual rules requiring safe practices.

First Aid—Usual rules, and directions for resuscitation by the prone pressure method.

Yard and Railroad Crews—Special rule book provided.

(Mr. Ingham then read his very interesting article printed in the *National Safety News* of May, 1921, describing cases of apparent "carelessness" which were really due to poor eyesight or other physical defects.)

STUDYING THE PEOPLE BEFORE THEY ARE HURT

We shall in all probability continue to find dangerous places and dangerous machinery to guard by mechanical devices. That is now our easiest problem. But if we are going to make progress in accident pre-

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vention we must analyze our accidents and study our people in relation to their jobs.

In going through my records and those of our hospital, making a statistical study of the frequency of certain types of accidents, I came across several cases, three of which I will cite; we are constantly on the alert for similar cases. These are reported to the management and taken care of through the employment office and the mills.

Johanna ————, Spinner Dept. Age, about 60; female; married. This woman in my opinion is a potential accident and compensation case. Her medical history would indicate that she has a hernia. July 14 she came to our First Aid Room and said that for 24 hours she had felt dizzy and had a sense of falling. She had a similar attack about 5 years ago which lasted several days. About a year ago she came to Dr. Stevens complaining about a lump in her left groin, which was about as large as a goose egg, and which had appeared periodically for a few days' duration for several years. The last appearance was about four months ago. She must work to support herself. I believe that the work this woman is doing undoubtedly increases the liability of her suffering an acute hernia and would recommend other work for her if possible.

Ella J————, Spinner Dept. Age 43, female, single, Scotch. This woman's history indicates that she is a potential compensation case because of heart trouble. At intervals of two or three months it is necessary for her to have a rest for a week in order to recuperate and continue her work. Her attacks bring on acute nervousness and heart palpitation. There is no doubt in my mind but that the work this woman does augments her condition and that sooner or later she will be a compensation case. I would recommend if her living depends on her employment that she be given much easier work.

Lewis M————, male, 28 years old, single, Portuguese. This man has been employed about five years in Dept. ————. In April he was laid off on account of the business depression, and on June 6 was transferred to the labor gang in the ward. This man is blind in the right eye. His employment card shows his condition and recommends him for a certain job in Dept. ———— only. On June 14, he struck his right knee while pushing a truck, evidently unable to see the box he struck, it being on his right side. He is now suffering with water on the knee, and the period of disability will be seven or eight days. I recommend that this man be given other employment suited to his physical capacity upon his return to work.

The first two cases were disposed of by finding easier work for the women. The last case was disposed of by taking the man off the payroll of the yard gang and returning him to that of the department where he had been employed five years without an accident.

In this analytical work of job and operative hazards, it is very necessary for the medical department to work in close harmony with the safety department. We have made the work dovetail at our plant and the results we are getting are very satisfactory. Very few accidents are unavoidable, and while we are practicing the therapeutics of accident work amongst our workers, we should also be on the alert for prophylactic

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possibilities. We are searching out the causes and thus preventing the effects.

DISCUSSION

MR. H. D. HOLMES (Gosnold Mills Company, New Bedford, Mass.): The spinners in our mills carry open knives in their aprons to cut the roping off with. Have any of you been able to meet that hazard satisfactorily?

MR. INGHAM: We insist that the knives have a rounded end, ground flat so there is no sharp point. The spinners also, and the women on the roving frames and on some of the cards, use a hook for picking sliver and roll. This hook had a loop in the end of it. We had a number of accidents because fingers were caught in the loop, so we took all the hooks away and furnished them with hooks with flat handles. They can't possibly get a finger caught in them now.

We had an accident a short time ago to one of our oilers. The long spout of his oil can caught in the twist gear and it didn't take long before it got to his hand. His effort to pull his hand out of the handle locked the gears and the result was a few slight abrasions on the back of his hand. We immediately gathered in all the cans and have soldered solid handles on the back of them and it will be impossible for a man to hold on to the can now if it is caught in the gear and suddenly jerked from him.

We have a number of minor accidents from blisters. Sometimes the spinners let their hand leathers wear out or neglect to put them on and in stopping the flyer they get a blister on the palm of the hand. We have been insisting that they report immediately when they have a blister so we can give it treatment and avoid infection. As I said in the paper we have cut our infections 80 per cent by insisting on immediate first-aid treatment for minor injuries of that kind. The treatment is iodine. We insist that the injured employee report every accident no matter how trivial to the overseer. The overseer then gives him a card for the medical department and he is compelled under penalty of layoff to go to the first-aid room for treatment. We figure that even though it takes fifteen or twenty minutes for a minor injury we may save fifteen or twenty days.

MR. W. A. MERRILL (Old Colony Manufacturing Corporation, Taunton, Mass.): Is it necessary that the floor of the color room be always wet and slippery?

Another question about color rooms—we occasionally have accidents resulting from what our nurse puts down as "color poisoning." Our chemists tell us that no color is used that is poisonous, and I don't know what that poison is or whether it is simply the clogging of the pores on the arms being continually in the color.

CHAIRMAN STOWELL: The floor in color shops does seem to be wet and slippery at all times and there does not seem to be any way out of it, even though it is frequently washed up.

In regard to the color poison, we have a great many cases of that kind. Some men cannot work with color. The color itself is not poisonous because men have been working in color shops for a good many years

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and are not affected by it at all. But occasionally we have a new man come in, go into the color shop and his hands become apparently infected by the color and he has to be taken out and put in some other part of the plant.

CHAIRMAN STOWELL: Will the nominating committee report?

MR. HITCHCOCK: We ask for an extension of time; that nominations be made by mail and a mail vote taken, and the present officers remain in their positions until that time.

(This was agreed to.)

MR. INGHAM: I would like to inquire whether anybody has made use of the continuation school to teach safety?

CHAIRMAN STOWELL: That is one of the best places to teach safety. In Lawrence, where the schools pay a good deal of attention to safety instruction, it is being done in the continuation school by the regular teachers, and all through Massachusetts the authorities in charge of these continuation schools encourage the teaching of safety. I don't think it has been taken up very extensively yet, but something has been done towards getting it into those schools.

THE VALUE OF BULLETINS

MR. F. D. WARREN (American Mutual Liability Insurance Company, Boston): The question is frequently asked in some plants as to how much good safety bulletins do. The other day a fellow said to me: "A foreigner can't understand them any more than a child." I asked him, "Do you think he understands them as well as a child?" He said: "Yes, I guess he does." So I quoted him a little case that occured in my own home.

I had a little "safety" pin and my little girl, who was four years old, begged for it so hard I gave it to her. She asked what it meant and I told her "Safety First." One Sunday morning she and her little brother got to fooling, and the little fellow got a shove, and as he began falling she got him under the arm and lifted him up and said: "Safety First."

I think if we can start them young and start in the school we are going to have a much easier job to get allies for safety.

CHAIRMAN STOWELL: The manual rate of the insurance companies for compensation insurance could be reduced very greatly if all the mills in Massachusetts would unite on safety work and do things in a systematic way. Some mills have done a great deal and reduced their rates by getting discounts, but their rates are still held up because other mills are not doing very much. And it is well to co-operate with everybody. If your mills are not members of the National Safety Council, which has done such great work in accident prevention, they should be. The expense isn't very great, and one or two bulletins you get in a year may pay the whole cost of your membership. The very largest plant only has to pay $200 a year, and I have heard men in some large plants say that one bulletin very often more than pays for that $200.

MR. INGHAM: Our bulletins are photographs of the machine in operation, and some of the late textile bulletins of the National Safety Council,

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we have noticed, have been based on the bulletins that we use in our plant.

We have had criticism for not publishing bulletins in foreign languages. If we put a bulletin up in English relative to a change in time or a change in the wage scale, our foreign employees get to know about it pretty quickly, and I have found that with bulletins printed in English our foreign-speaking employees, if they are sufficiently interested, will ask someone who does read English to tell them what they are about; and I feel that we accomplish more by having some English-speaking foreigner explain to a non-English-speaking foreigner the text of a bulletin than we would if we printed the bulletin in a foreign language.

MR. C. H. LIEBFRIED (American Mutual Liability Insurance Company, Boston: Speaking of bulletins reminds me of one I saw a short time ago. A boy went under a mule spinning frame to clean it, the machine was accidentally started, the carriage ran back and caught the boy and killed him. After this accident happened they put a device on to hold the machine still during the cleaning operation.

Since that time it had been noticed that a machine started even with a device on, and they posted a notice that all mules when stopped for cleaning or any other purpose, if possible, must be stopped with the carriage running out so that the mule would run out and stop the length of time it takes to do the spinning, which would give a man or a boy ample time to get out. I think that is a very good bulletin and a very good scheme.

CHAIRMAN STOWELL: Mr. Fisher, can you tell us how safety appears to a service manager?

WHAT A SERVICE MANAGER THINKS OF SAFETY

MR. BOYD FISHER (Lockwood, Greene and Company): I like to view the personnel job as a whole, as one job. You have to think of a point of view with which you go into your work, and it seems to me, first of all, that the point of view that animates safety work must accord with the point of view which animates all personnel work.

I personally hold the point of view that industry must govern itself by the motive of service—not merely that this should be the motive of the service department, but that industry as a whole must justify its existence as one means of serving the human being, whole and entire. I don't think of industry primarily as a money-making institution. I don't think of it as a thing that exists for its own sake. It isn't like the German state, or any other theory of the state, which is superior to the individual and for which the individual must sacrifice. I think of it as just another means and one of the principal means of increasing the sum of human satisfactions.

Therefore, industry must always be checked up from time to time, at least, and I believe continuously, as to whether it is serving as a means of livelihood, as a promoter of good things, and that it hasn't elevated itself into a position where it disposes of human life as a mere aid to itself.

Once we admit that industry is subordinate to human interests, we

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see how terrible was our misguided attitude for so many years in ignoring the question of human safety in a plant. The old "fellow servant" doctrine, the doctrine of the assumption of risk, the doctrine of contributory negligence, those three standbys which were called into court from time to time to protect the employer from paying any kind of damage or compensation when he chewed up his employee, testified to the fact that industry had not got very far toward the idea of existing for the service of humanity. And the very first step which turned industry in a new direction was the safety movement.

In many respects it is the proper forerunner of good service work in other departments. In many cases it has inaugurated service work. It is our first duty, our first charge on service work to see that at least the actual life and health of the operative is not sacrificed to make a one per cent additional dividend.

So when you ask me what is the relation between safety and service work as a whole, I have to reply that I consider it the first charge on service work. It is our first duty to see that the man who goes into the mill in the morning shall come out whole at night.

SAFETY SHOULD INCLUDE HEALTH, BOTH PHYSICAL AND MENTAL

But safety isn't to be regarded merely as not getting hurt, but as preserving the vital organs that keep the human machine going. We have got rid of the larger part of the menace of tuberculosis, and we have got rid of many of the great epidemics, such as yellow fever, and we have cut down very materially the hazard of malaria. But experts on health tell us that the so-called degenerative diseases, diseases of the heart, lungs, etc., which are not diseases so much as gradual impairment of those organs, are on the increase, and I am inclined to believe that we could prove much of the increase is due to conditions of work.

So if we look not alone to safeguards and accident prevention, but look also to the question of fatigue, the question of industrial poisoning, the question of monotony, and the question of plant hygiene, we are taking the legitimate next step in safety, which in many cases we have already taken. We must not forget, just because accident compensation insurance does not extend necessarily to those gradual impairments, than our moral responsibility is just the same towards those things as it has always been toward accidents. And we may even anticipate that some day we shall have a form of sickness insurance, or something of that sort, which will force us to acknowledge the extension of our obligation in that direction.

But should we stop there? It is, after all, a short-sighted point of view which regards merely the physical health of an employee. I have always felt that it is possible to make industry a career which in itself exalts and improves the human mind, taking it as it is, leading it to something better; and we shouldn't be entirely indifferent to the mental conditions in industry, the things which gradually solidify and crystalize the human mind into a thing that is inflexible, hard, prejudiced, ruled by emotion, not ruled by intelligence—the average adult human being a mere moving machine with hardly anything that you can call mind. So we

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shouldn't be indifferent to the things in industry which contribute to the deterioration of the human mind.

I didn't mean to go so far afield, and yet it seems to me that you cannot halt at any one point the work which you gentlemen have begun in safety. You have to ask yourselves: "Why do we do it? What is our motive in doing it?" And once you admit the only best and proper motive for accident prevention, it seems to me that you only have to let your imagination work to see how far it carries you into fields that we don't usually consider in a safety congress.

And so the motive of general service work and the motive of safety work, in my view, is one and the same motive, and whereas safety work may very properly constitute a separate profession, owing to its engineering aspects and its specialized knowledge, I am quite convinced that service work and safety work are almost synonymous, and that they have to work hand in hand.

CHAIRMAN STOWELL: Mr. Fisher said just what I thought he would say and what I wanted him to say, and I knew he could say it a good deal better than I could, and I am very thankful he is here.

I can agree with him that it is hard to say where safety ends and service begins. In the plant where I am now it began with safety and nobody planned to have it grow into service, but it grew itself. And, while I believe the safety engineer in the plant should be responsible to the biggest man in the plant, it is a step in the right direction to connect the safety work with the service department.

MR. MCGINNIS: I listened with much pleasure to Mr. Fisher. We are disciples every one of us, with one common thought, the thought of making things safe for the man.

VALUE OF PLANT RESTAURANTS

There is one factor which I think plays a very important part and that is the question of food. It makes all the difference in the world whether a man is functioning properly inside. In some factories the employer provides the food for the workers and sees to it that the food is of the proper quality, well cooked, and a balanced meal. I would like to hear a discussion of that subject.

CHAIRMAN STOWELL: We have had a case of that kind. We have one part of our plant which is in a part of the city away from any restaurants or lunch rooms and there has been a restaurant built there, with splendid results. We have an overseer who is eighty-three years old and yet he is one of the youngest men in the plant and takes a great interest in everything. He went over to that department to visit the restaurant and see what it was, and after he had seen it he said, "That restaurant has created more good will in the short time that it has been there than all the talking you have done in the past two years."

ADJOURNMENT.

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Women in Industry Section

September 28, 1921

MISS TRACY COPP, Chairman
Special Agent, Federal Board of Vocational Education, Washington, D. C.

MISS NESTA C. EDWARDS, Vice-President
Consultant in Industrial Service, Chicago

MISS ALICE B. SMITH, Secretary
Employment Manager, A. George Schulz Company, Milwaukee, Wis.

CHAIRMAN COPP: It is necessary for the chairman to appoint a nominating committee this afternoon, which committee will report at the business meeting tomorrow. Mrs. H. M. Hopkins, of the National Enameling and Stamping Company, of Baltimore, is selected as a member of that committee; Miss Emilie Raub, of the Dill & Collins Paper Company, Philadelphia, and Miss Nelle Swartz, of the Women in Industry Division of the Department of Labor of the State of New York.

The officers of the section have decided that you shall be permitted to hear the noted speakers we have this afternoon and hear nothing more from the officers except a word from our secretary, Miss Smith. I have asked her to introduce Mrs. Gilbreth.

MISS ALICE B. SMITH: Before I introduce Mrs. Gilbreth, I will give a very brief report of the work of the Women in Industry Section. This is the third anniversary of the organization of the Women in Industry Section of the National Safety Council. The section was organized as a result of war needs, which arose when women went into new industrial pursuits. Women's entrance into the more hazardous trades has not only emphasized the general accident problem but has also brought to light the peculiar necessities in our program.

This section of the Council has sought to bring to the attention of the member companies of the Council the problems in connection with the employment of women. It has further tried to advise and confer with the members of the Council as to the necessity of making work places safe not only for women workers but for all workers, both in regard to accident and health. Contributions have been made from time to time in the *National Safety News* on safe clothing, factory housekeeping, and factory sanitation and other allied subjects. The officers of the section

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have taken part in the National Safety Council's and local councils' work in the communities in which we live, both in the way of public speaking and special committee work.

It gives me a great deal of pleasure to be able to call Mrs. Gilbreth a friend of mine, and it gives me a great deal of pleasure to introduce to you today Mrs. Frank Gilbreth.

FATIGUE STUDY—A FIRST STEP IN SAFETY WORK

FRANK B. AND LILLIAN M. GILBRETH, CONSULTING ENGINEERS,
MONTCLAIR, N. J.

It is a great privilege and pleasure to talk to you today and to be able to testify to the splendid co-operation that the National Safety Council has always given to all other lines of activity. It is because of this fact that we who are so interested in fatigue (and that means every one of you, I know) are so especially pleased to come before the safety people and talk upon the relation of fatigue and safety, because we know that we are among our friends and co-workers when we are here.

Fatigue study is the first step in motion study, and it is also the first step in safety work. The reason that it is the first step is because it decreases the number of accidents as well as decreases the wastefulness of operation methods themselves, and therefore, lessens the number of problems that must be considered.

RELATION OF FATIGUE TO SAFETY

The problems of fatigue and of safety bear a peculiar relation to one another. Fatigue causes accidents. Fear of acidents causes fatigue.

We realize fully the value of safety work in fatigue elimination. Doubtless such work often arouses interest in and helps fatigue study. The National Safety Council has always been quick, also, to recognize the close affiliation between their work and fatigue elimination. They have a representative on the Committee for the Elimination of Unnecessary Fatigue of the Society of Industrial Engineers, which serves as headquarters for this work,[2] and a speaker from that committee is often asked to participate in their programs.

It will not, therefore, perhaps be amiss to discuss just how fatigue study can prove most useful in safety work, and to refer to existing writing on fatigue that may possibly prove useful in safety work.

There is no thought of combining the two types of work, so far as avenues of arousing interest, societies that group those interested, or methods of securing the co-operation of the community is concerned. The work to be done is so great, and especially at this stage, the vital needs of making "Safety First" and "Eliminate Fatigue" both universal slogans is so depressing that all existing activities that handle the extensive work have more than they can do.

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[1]Fatigue Study, Chapter V. Pages 85- 86.
[2]See Report of Chairman, Proceedings of Spring Convention, April, 1921.

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But in the plants themselves, where the intensive work takes place—in other institutions, in the office, the hospital, the school, the home, the same methods and devices can often be used effectively to do both types of work. For example, the survey.[3] The first step in fatigue study is the survey of present existing conditions. The fatigue survey makes a most convenient form and outline for analyzing, reviewing and improving the accident causing conditions as well as the motion study conditions. It can be started in any organization instantly. It forms an outline for a method of attack, and it offers a basis for interchangeable data in organizations doing entirely different kinds of work.

SUGGESTION SYSTEMS STIMULATE THOUGHT ON FATIGUE

Again, the suggestion system that exists today in so many plants may well lay emphasis on safety and on fatigue elimination. The systematic incorporation of "shop kinks" into operation methods will not only better these, but will arouse a definite, concrete interest in both subjects, an investigation into the theories and a first hand, intimate contact with the practice. The importance of the suggestion system as a vehicle for stimulating thought has seldom been realized, even by many of its enthusiastic users.[4]

The "Home Reading Box"[5] may be used as a medium for circulating literature on safety as well as fatigue. We are continually surprised to find ready readers not only for the news and fiction magazines that are put into the box, but also for trade catalogs, technical magazines and other literature that has to do with plant organization, operation, and betterment. Through the home reading box, the homes are reached, especially since such boxes are being introduced into schools as well as plants. The first school home reading box, so far as we know, was established at the Nishuane School, Montclair, N. J., last spring. The principal is far-sighted enough to leave all supervision and actual operation of this to the pupils, thus using it to develop initiative and executive ability as well as co-operation and interest in reading. It has proved a decided success.

The museum idea has already been started, and is progressing rapidly, in both safety and fatigue work. This covers not only a national museum, but a museum in every plant and organization if it is no more than a book of photographs, to arouse and focalize interest. Where either a safety or a fatigue museum exists, those interested primarily in the other might well study the exhibits from both viewpoints, and bring out advantages from both in the descriptions or captions.

The "Information Bureau" may be used as such a museum, until space and interest for a real museum can be provided. It is often advisable to work through an existing activity, till the new enterprise is strong enough to make its own way. The Information Bureau, which exists in many plants at least in embryo, though possibly under another name or

[3]Fatigue Study. Chapter 2.

[4]See "One Best Way to do Work," presented before several Chapters of the Society of Industrial Engineers, May, 1920. Pages 6 and 7.

[5]Fatigue Study. Chapter IV.

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under several different persons or functions, is a splendid starting place for a museum.

It should be noted that all these vehicles—the survey, suggestion system, home reading box, museum and information bureau—are activities that appeal to and are available to all members of an organization. They are non-controversial activities in which all can co-operate. Both fatigue and safety are non-controversial subjects. Work along both these lines is useful not only in itself but as furnishing a field where all may *practice* co-operation.

METHODS OF REDUCING FATIGUE

The same mediums may also be used in actual installation of results in the plants. Rest periods, chairs for work and rest,[6] including chairs with springs on legs and foot rests to remove the effects of vibration—these have an accident prevention as well as a fatigue prevention aspect.

Unnecessary noise, which has been considered an expected part of life in the street, the home, and the office, is an evil to be combatted. Two papers on noise,[7] one by Professor Henry J. Spooner,[8] one by Mr. J. S. Hoeghiemstra, a pupil of Professor Volmer, the well known economist and anti-fatigue enthusiast, may well be reviewed for new aspects of this cause of unnecessary fatigue and preventable accidents.

The importance of proper lighting is often underestimated. Facing workers toward the glaring windows, as is done even in otherwise well regulated shops, where "much light is needed", makes the work in silhouette to the worker. Too much emphasis can hardly be laid on the old fashioned idea of "light from the left side for right handed workers", if the irreducible minimum of fatigue and fewest accidents is what is constantly striven for.

"White paint and white walls everywhere" should be not only a slogan, but a law. Paint the color of puree of pea soup, so popular in several large and prominent factories in America, would be covered with white paint immediately, if the managers had actual tests made of the fatigue caused to indoor workers by lack of maximum indirect sunlight. The belief in "neutral tones" of interior paint is founded on a fatigue amateur's guess, not on the results of research. The relation of white paint to possibilities of the "One Best Way to Do Work" is not realized in our country.

For example, our organization has found that it takes considerable time to get clients to paint all parts of tool rooms and tool cribs the whitest white. At first it is thought this will be hard on the workers' eyes. It might be, if too much artificial light accompanies it, but there never can be too much indirect sunlight in a tool room or a tool crib.

All such preliminary "work in common" in safety and fatigue can be supplemented and developed as soon as seems advisable and profitable by a more scientific investigation and procedure.[9]

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[6]Posture and Seating, Report of Dept. of Labor of State of New York.

[7]Proceedings of Society of Industrial Engineers, Spring Meeting, 1921.

[8]See "Industrial Fatigue", also "Wealth from Waste."

[9]Fatigue Study. Chapter VII.

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THE ONE BEST WAY TO DO WORK

The method of finding the one best way to do work, which is a fundamental part of the science of management,[10] has been thoroughly worked out and is identical to the method for obtaining the method of least fatigue and also the method of fewest accidents.

It is fortunate that the methods of obtaining these three great divisions of economic progress are identical, because it again emphasizes the truth of what the National Safety Council has always maintained, namely, that safety work actually pays in money as well as in the durable satisfactions of life.

Finding the one best way to do work, including fatigue study for eliminating unnecessary fatigue, must include also the minimum of accidents, for in no other way can the lowest costs be obtained, the fewest absences, the highest wages not only per hour but also per year.

The investigations that lead to finding the one best way extend not only in the field of management and especially of motion study, but into the fields of physiology, psychiatry, psychology[11] and other sciences that concern themselves primarily with the "human element."

IMPORTANCE OF HABIT

Let us take simply one variable of motion study, habit, or state of automaticity, and note how important it is in both safety work and fatigue study. It is one of numerous variables, many of them equally important.

Habit, so long considered a cruel master, is now realized to be the most useful of helpers; automaticity firmly established habit, may become dexterity and finally skill.

Our organization has devoted many years to the study of the problems of habit, and we have found that the best results come from the procedure of analyzing all work from the standpoint of the *decisions* and *motions* of which it is constituted. Unimportant decisions are turned over to automaticity, in order to leave the mind free for the achievement of the more important things which will improve the method or lead to promotion.

As far as possible, useless, inefficient, and ill-directed motions are discarded, and the sequence of necessary motions is determined, so that the body can perform these with least effort, least fatigue, and largest resulting wages. When these motions are performed with such dexterity that automaticity results, we have a really efficient process.

If there is a dangerous condition accompanying the result, known to the worker, it not only causes unnecessary fatigue, but interferes with his automaticity.

HABIT, FATIGUE, AND SAFETY

It is seldom realized how fatigue, or worry will interfere with automaticity.[12] As an example, we call attention to the fact that, as fatigue

[10] See "Time Study and Motion Study, an Indictment of Stop Watch Time Study", Bulletin of the Taylor Society, 29 West 39th Street, New York, June, 1921.

[11] Motion Study. Psychology of Management. Pages 67-69.

[12] See Bulletin of Life Extension Institute on Fatigue.

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slows down the motions, motions are not the same, because fast motions and slow motions differ as to path or orbit[13] and in many other respects. Not being the same, the automaticity is destroyed, for the time being at least. Automaticity being destroyed, there is more fatigue and then there are more accidents.

The so-called "irreducible minimum" of accidents can, therefore, be reduced by the study of the phenomena of automaticity of motions and habits of thought.

In the same way, the use of the methods of measurement of motion study, the micro-motion method and the cyclegraph method,[41] can be applied to accident as well as fatigue elimination, by determining the accident causing features of an operation, and studying (1) variables of the worker; (2) variables of the surrounding conditions and tools, and (3) variables of the motion,[15] with the emphasis on findings that effect safety.

We have included in our study of the phenomena of automaticity of motions, the study of the motions of epileptics in seizures. The relation of our findings to safety work was presented to the National Safety Council in brief form in the summer of 1920, and those interested can find information in the proceedings and also in the proceedings of the National Association for the Study of Epilepsy, covering the summer of their 1920 meetings.

THE HOME A NEGLECTED FIELD FOR FATIGUE STUDY

It is rapidly being realized that the field for application of both safety and fatigue work is practically unlimited.

The home is, perhaps, by far the most neglected field. All of the preliminary as well as the scientific methods of handling the problems are fitted for use in the home. Many such methods can not only benefit by home co-operation, but can actually be installed in the home easily, and with direct and indirect profit. There is not time to elaborate on this most attractive topic, though it demands immediate and widespread attention, since the home makers are a vital element in the community.

It would seem as if there could be no question as to the value of careful investigation in this and every other field, though unfortunately there are still a large number of people whose knowledge of economics is so limited that they do not realize that the elimination of all kinds of waste is beneficial to everyone. Nor would it seem possible that the value of co-operation could be underestimated, especially after its power was so wonderfully demonstrated in the great war. We have found that approaching waste elimination through fatigue study and safety work invariably hastens the day of hearty co-operation, for both subjects enlist attention and interest.

When this co-operation extends to safety and management engineers, who use the same methods of careful investigation and exchange their

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[13]Applied Motion Study, Pages 109-119.
[14]Applied Motion Study, Chapters IV and V.
[15]See Motion Study, Pages 6-7.

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data, we shall have reached another phase in the development of both safety and fatigue study.

DISCUSSION

CHAIRMAN COPP: Dr. Wright will discuss Mrs. Gilbreth's paper.

DR. WADE WRIGHT (Harvard Medical School, Boston, Mass.): I don't think that there can be any doubt in the minds of any persons concerned with any phase of industrial disability, that fatigue plays a very important part in the causation of such disability, whether from accidents or from illness. I feel, however (a feeling which I think is shared by many persons interested in the physiological aspects of the study of fatigue) that at the present time we lack very satisfactory evidence of the exact nature of fatigue, and we lack satisfactorily accurate criteria regarding its existence, as well as regarding the degree of fatigue which may exist. If it were possible to more accurately gauge fatigue, we might more accurately than we are now able to do, reckon the part which fatigue plays in the causation of accidents and the causation of illness. I think that few people believe that such things as output studies, as have been made notably in England and here, are satisfactory evidences of the extent of fatigue.

Possibly it is because I approach the subject from the point of view of the physician that I cannot but feel that we would be able to study fatigue very much more accurately than most studies have been conducted, if we should take into consideration to a greater extent than has been done the physical and mental state of the human subjects under observation. It seems to me sometimes as if, in studying the evidences of fatigue in our industrial workers as we find them in the various plants, taking them as they are, we were studying material of unknown composition, as if we had seized upon a runner, possibly, near the end of a race and then carefully timed him for another lap. You cannot fairly estimate a runner's ability, nor for scientific purposes very satisfactorily reckon his powers, by testing him on one of the laps of the race after some of them have been run, and you know nothing precisley regarding his condition at the time in which you are estimating. If an engineer wished to consider the stress which could be applied to certain materials without excessive resulting strain, it seems very likely that he should very carefully consider the nature of the material which he was taking up, unless he were going to take it as wholly a unit and possibly a material which would not lend itself to an analysis.

I think it is fair to assume that we are concerned with the safety of individuals, and you cannot consider them very satisfactorily as anything but individuals—not average individuals or poor individuals, or for this purpose even the expert or the super-expert individuals.

It is a reasonable, perfectly fair, desirable thing, I believe, to study fatigue by the best means we can find, and we need all that can be done to add to our knowledge of this tendency in industrial activity which is probably responsible for more illness (and for many accidents) than any other single cause.

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MUST PREVENT CAUSES OF FATIGUE

We are fully justified in endeavoring to rescue from deep water the old gentleman who has fallen off the dock, but it would be very much more reasonable, I think, to keep the dizzy old gentleman from falling off the dock. It seems to me that it is just as reasonable to consider that a few unnecessary postural defects, unnecessary visual defects, several unnecessary belly pains, a few unnecessary family worries, may be productive of fatigue and may affect production almost as strikingly and conventionally as a few unnecessary motions in an industrial operation.

It is rather interesting (and I think it reflects particularly upon the part which the medical profession has played in this field so far) that the literature regarding fatigue study abounds in considerations, very thoughtfully worked out, of the environmental conditions of industrial operations and very, very little with the individuals who are being observed. If we are to have reasonably accurate estimates of the physical and mental states of our industrial workers, it certainly is incumbent upon the medical profession to learn something, which, broadly speaking, it does not now know, regarding the nature of incipient disease and the method of its detection, which is quite as necessary as to devise methods of protection against incipient fatigue.

It is a thing to be hoped for, a thing attained to some extent undoubtedly, that we know the one best way to work, so far as the technical operations are concerned, and in determining this one best way to work. I think Mr. and Mrs. Gilbreth have made contributions which are almost incomparable, but I feel that in another sense we shall come to realize that many of our present day, very pressing, very urgent industrial problems, both as regards production and as regards the elimination of accidents, will be solved by maintaining the healthiest possible bodies and also the healthiest possible minds.

CAPTAIN WM. P. WHITE (U. S. Navy, Retired, and President and General Manager of the Lowell Paper Tube Corporation, Lowell, Mass.): I was very glad to hear Mrs. Gilbreth accent white paint. I remember when the fleet of our country was all painted white, the psychological effect of that was very remarkable. It certainly gave us a reputation for having clean ships outside and necessarily clean ships inside.

I have been on the ships of many nations and I have found none that were cleaner than ours, and I think the white paint outside was one of the primary causes for order and cleanliness inside. At least, wherever I had an opportunity of introducing it, I found a demonstration of its great value not only in keeping things clean but also in order.

MISS NESTA C. EDWARDS: Have any studies been made on the effect of health which has been supposedly produced through fatigue which comes from working in dark rooms?

DR. W. A. SAWYER (Eastman Kodak Company, Rochester, N. Y.): I regret that Miss Edwards has brought up this subject. Unfortunately, so far as the Eastman Kodak Company is concerned, no very exhaustive studies have been made along that line.

We have often been accused of ruining the health and welfare of young

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people who work in dark rooms, but as yet I think no specific case has ever been brought to our attention where that could absolutely be proved. It is a question that the Eastman Kodak Company has been interested in for a good many years.

Personally, I have been there only two years and during that time have not met with a single instance where ill health could be traced to the work in dark rooms. Some of the people who have worked there ten, twelve, fifteen years, and even longer, seem to be in the very best of health. It is certainly worthy of study, and that is something which we contemplate.

MISS EDWARDS: I don't want Dr. Sawyer to think that somebodv is trying to "rap" the Eastman Kodak Company. I happen to know that their dark rooms are the most perfectly ventilated rooms in the United States.

DR. GEO. M. PRICE (Joint Board of Sanitary Control, New York City): Let me add my testimony to that of Dr. Sawyer about the Eastman Kodak Company. In 1912 I made an investigation of the effects of sojourning in the dark rooms on the eyes and on the general health. The investigation was rather superficial, but what we found out was that it has absolutely no effect upon the eyes and probably has no effect upon the general health of those remaining in the dark room.

CHAIRMAN COPP: The next speaker is Miss Nelle Swartz.

INDUSTRIAL POSTURE AND SEATING

MISS NELLE SWARTZ, CHIEF, BUREAU OF WOMEN IN INDUSTRY, NEW YORK STATE DEPARTMENT OF LABOR, NEW YORK CITY

A prominent industrial engineer is quoted as saying that the average factory chair always reminds him of the time-worn story of the coffin: "The man who made it didn't want it, the man who bought it didn't use it, and the man who used it didn't have anything to say about it." Hitherto, the principal aim in producing seats for factories or stores seems to have been to produce a chair that was unbreakable rather than one that was corect from the physiological point of view. A trip through the average plant is almost sure to disclose startling novelties in the way of seating arrangements. Twenty different kinds of chairs may be gathered from the same plant, no one of them a really satisfactory seat. They have been purchased at different times by different people for use at different processes, but the only considerations have in all probability been cheapness, durability, and free aisle space. As a result of this, in many cases improvements have been attempted by the workers; backs have been put on or knocked off, arms or cushions have been added, a box or barrel has been made into a seat, a chair seat has been raised by using a block or strip of wood, or the particularly ingenious workman has built out a seat from some part of his machine.

The difficulty seems to be not only that very little thought has been

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given the question of industrial posture, but also in many instances the impossibility of scrapping old equipment, constructed with no regard for the breaking back or the dangling legs of the tired workman.

CORRECT POSITION IMPROVES WORKER'S EFFICIENCY

However, it is fortunately coming to be true that manufacturers are beginning to realize that a correct position at work saves energy units and means increased efficiency in production. Consequently they are beginning to demand a chair for their workers which has been constructed with some knowledge of physiology in addition to its unbreakable features. The possibility for good posture at work has not been assured, however, when a good chair is secured. The relation of the different parts of the work place—the bench, chair, foot rest, place for supplies, and the place for finished work—must be considered; the chair may be too high or too low for the work bench or machine; a brace or set of drawers may prevent a proper position of the worker's feet and legs.

Th management of a large plant recently decided to replace round top stools in one department with chairs which had been highly recommended; these chairs were pointed out to a visitor with great pride, yet the workers were all standing. It turned out that the work bench measured thirty-one inches from the floor, while the chairs were twenty-eight inches high; it was an impossibility for the workers to get their knees between the chair and the bench and the result was that these superior seats were never used.

ALTERNATE SITTING AND STANDING

The Division of Women in Industry of the New York State Department of Labor, during the late winter of 1921, in response to many requests from manufacturers, studied the question of industrial posture and seating. In publishing the results of this study, the division makes no pretense of saying the final word, for, like many details of industrial management, much more is still unknown than is known. Starting with the concrete idea of collecting the best possible designs for chairs for industrial workers, the division soon realized the problem in reality was the question of eliminating, insofar as possible, the fatigue which comes from bad posture, or from continuously working in one position.

Lack of imagination is responsible for much bad seating; custom has decreed the way in which many operations are performed; there has been next to no effort scientifically to fit the work to the workers except where industrial engineers have realized that unnecessary fatigue is needless loss, and that in order to reduce fatigue, work must be physiologically balanced. The conclusions and recommendations of the study of the division are briefly:

First: That posture should be varied, and, second, that work conditions should be such that correct posture is made possible.

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Continuous standing and continuous sitting are *both* harmful and for this reason the importance of variation in posture cannot be too strongly emphasized. While there has been a great deal of testimony from physicians of all countries as to the harmful effects of long hours of standing on *women* workers, varicose veins, flat feet, and knock knees are frequently found among men . . . pressers, apprentices in bakeries, motormen and conductors, and it is becoming more and more true that the demands of the particular operation must be considered more than the sex of the worker. Conditions should be such as to allow the worker to vary his position at will, because of the rest and the enormous saving of energy which comes from a change of position during working hours. In one of the large collar manufacturing plants in New York State, where about four hundred girls were sorting collars—very tedious, monotonous work—there was a small extra folding table top at each girl's place of work, so that she could push her chair back, open up the folding top and stand to do her sorting. When one enters this department, about fifty per cent of the girls are sitting and fifty per cent are standing, and each girl can vary her position as she wishes, and still be in the same relation to her work.

HOW POSTURE MAY BE VARIED

The most usual method of making it possible for work positions to vary from sitting to standing and vice versa is to raise the work bench to a standing height and use a high chair with a foot rest properly arranged.

When it is impossible to vary the worker's position while at work, either because equipment and machines have been constructed with no thought of allowing variation, or because the operation is one at which only one position is possible, other means have been found to enable the change to be made. One such means is having an interchange of processes so that a worker changes at regular intervals, not only his position but also his work. In a large ribbon mill in New York State for example, one department which did "blocking" in a standing position interchanged every two hours with another department which did "pinning", a process requiring a sitting position.

Another means used is the regulation of handling supplies so that the worker is forced to rise from that operation at which she has been sitting and take the finished article to another department. Thus of necessity operators rise, walk about, and change their positions. A production engineer tells of one instance in a clothing factory where the workers on piece work never paused during rush hours or rose from their chairs. Supplies were brought to them and on a long wall right behind them their wraps were hung; at noon they reached for their lunches, usually in their coat pockets and ate at their machines. In his reorganization of the plant, he removed the wraps to a distant part of the floor and regulated the supplies in such a way that the workers were obliged to rise and walk about. Instead of considering this a waste of time, it was definitely planned as a means of increasing production.

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PURPOSE OF REST PERIODS

The most popular means employed to vary posture is the introduction of rest periods. The fundamental idea of the rest period is that through change of position, interest and energy are renewed, and the worker is prevented from reaching a condition of over-fatigue. Rest periods may be automatic, due to pauses inherent in the nature of the work, or may be compulsory, set by the management to be taken at a fixed time for a definite number of minutes, or the rest period may be taken at the discretion of the worker by permission of the management; the latter type of rest period, however, too often is not taken at all, especially if the worker is on piece work. The workers frequently ask that compulsory rest periods be eliminated so that they may leave that much earlier at the end of the day. Such a plan, of course, in no way brings the same results, for the rest period should be planned scientifically to make a break in the work at a time when a change is most needed.

The second recommendation made by the Division of Women in Industry is that *work conditions should be such that correct posture is possible.*

This means first, providing a physiologically good chair and, second, insuring the proper relationship between the different parts of the work place.

REQUIREMENTS OF A GOOD FACTORY CHAIR

What the best chair is, depends in a large measure upon the type of work, the muscles most used, etc. This is particularly true as related to the height and depth of the chair. The chair seat should be broad, not too deep and slightly saddle shaped, with the front edge rounded; this front edge is often a source of trouble; if it extends too far under the knees the circulation is cut off; if the edge is left sharp and not rounded carefully this tends to cut off the circulation no matter what the depth of the seat may be.

The most satisfactory material for a chair seat is wood. Cane seats are apt to become saggy and metal seats are too hard, or are made with sharp edges which cut off the circulation.

The type of back which is most satisfactory for a seat depends again on the nature of the work. Where constant lifting or reaching is involved, the back, unless carefully constructed, may interfere with arm movements. The California Industrial Commission in approving seats for women workers in the canneries, chose one with a rectangular seat and no back. In general, backs are used by the workers and are recommended. Any chair which is to be used for rest should, of course, have a back. The American Posture League recommends that there be an open space about seven inches from the seat floor before the back rest begins. This would enable workers to sit well back in the chair. Support should be given at the small of the back and the support itself should be at least two and one-half inches wide and slightly curved. Sharp edges should be avoided and the horizontal supports should be spaced so that they do not pinch the worker by being too narrow or

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prevent the necessary space needed at the base of the chair by being too wide.

But it is not enough to provide even the best chair that can be made according to physiological standards. For the possibility for good posture, *sitting or standing* depends in large measure upon the *proper relationship of the different parts of the work place.*

This means again a study of the individual operation to be performed—the reach, the amount of pressure, the size and kind of supplies, the aisle space necessary, the height of the worker, etc.

After the work place has been so constructed as to heights, that the worker can either *sit* or *stand*, it may be said that in general the principles of correct seating would require that:

The chair would be broad and not too deep, slightly saddle shaped and with the front edge rounded; the worker's feet should rest comfortably on the floor or on a broad foot rest attached to the floor or bench; the work bench should be high enough to allow plenty of room for the knees between the top of the seat and the under side of the bench; no brace or other obstruction should interfere with a comfortable position of the feet and legs; a back rest should support the small of the back and not extend up far enough to interfere with free movement of the arms, and supplies should be so arranged that no excessive reach is involved in the work.

LITTLE ATTENTION NOW GIVEN TO PROPER SEATING

Many states have attempted to standardize seating in industry by passing laws compelling manufacturers to supply seats for their workers; such a law was passed in New York State as early as 1881, and in 1920 forty-seven states had laws requiring seats in mercantile establishments; thirty-six states require seats in both mercantile and manufacturing establishments and some few require seats in practically all establishments. These laws, as they stand, offer little protection to health, because even when a sufficient number of seats are provided it is practically impossible to see that employees are allowed to use them. As far as industrial posture and seating is concerned we are still in the stage of experimentation. So little thought has been given to the problem of posture in industry that at the present time almost any plant can go far in improving conditions by even the crudest attempt to plan the work place so as to give the worker a fair chance for minimum posture standards.

As general conditions now exist, any posture at all is as good as the best, and, of course, bad, cramped postures become the natural and comfortable ones. According to the Gilbreths there is a "one best way" of doing everything and the time has come for us to see to it that workers are given a chance for the "one best posture" at work—both for the sake of health and for the sake of standards of workmanship.

Most of the attempts at good seating in industry are obviously compromises between what has been and what might be; there are no absolute standards; the best we can do is to follow a few fundamental principles of good posture and refuse to accept what custom, with no

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regard for physical needs, has chanced to give us. Must a worker always endure a bench constructed too high or too low? Must a worker always use the conventionally bad chair? Must the housewife always accept the plumber's insistence that a sink and wash tubs be built at a back breaking height? To take some slight step in the right direction is usually so simple that it seems foolish to suggest it, but some step forward, however simple, is much better than no step at all, and we may eventually be able to have a commercial chair company's advertisement read, "A seat that never wears the worker out" rather than "A seat that never wears out."

DISCUSSION

CHAIRMAN COPP: Dr. George Price of the Joint Board of Sanitary Control, New York City, will read the discussion.

DR. GEORGE M. PRICE: Much credit, I believe, is due to Miss Swartz and the Bureau of Women in Industry in New York City for the splendid studies on the subject of seating and posture. I believe this is the first study which has been made in this country and it is a valuable beginning. The subject, of course, is intimately connected with that of posture and fatigue. This importance has been impressed upon me in my own work of supervision of the garment industry in New York City. We have nearly four thousand factories in New York City alone, with 85,000 workers engaged in making women's garments—cloaks, suits, skirts, dresses, and waists. Fifty per cent of these workers are women. Of these 85,000 workers, about 15,000 or 18,000 are pressers and cutters; they always stand at their work, they never sit, and no seats are provided for them, I suppose, in fear that they may use them sometimes. Although there are 65,000 more workers, of whom the largest percentage are composed of women, and who are seated at their work, the seats of course range from a mere box, a plain, simple box used for various goods to a more elaborate seat which may be found in any factory. No attempt has been made, of course, to make them adjustable or to standardize them. We have lately tried to take up the subject, I confess, due to the work of Miss Swartz, and are trying to evolve some method by which a better seating may be adhered to in the whole industry. We not only have to have certain seats, but our aisles are very narrow and we would prefer light seats, folding, if possible, so that in case of fire or panic, they could easily be taken up, either put on the bench or folded under the bench.

The solution of this problem of seating, as well as many of the other problems in industrial hygiene, of course, cannot be had by simply passing a new law, of which there are so many already, dead letters on the statute books. Neither more rigid inspection nor stricter enforcement will ever be able to give us better seating or better improved health in the factory or in the shop. The longer I live and the more experience I have in industrial supervision, the more I am convinced that you cannot make factories sanitary by issuing or promulgating sanitary codes, nor can you make people healthy or clean by law. Hence I believe that the main solution or the main efforts toward solution

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should be made by methods of education, by getting the interest and the intelligent co-operation of the employers, but especially of the workers themselves; for we have found that among the many, many thousands of sanitary defects that we are finding daily in our factories, fifty per cent of them are due to major defects, not to construction defects, but to the defects which are due primarily to the workers themselves.

MISS MARY KENNEY O'SULLIVAN (Boston): We may not make the people clean or healthy by enforcing laws, but we can make factories clean and healthy by enforcing laws; and Massachusetts is doing so.

It isn't humanly possible to have the standardized seat. It is possible to have comfortable seating and in Massachusetts all the women making small wears and neckties, women's wear, are seated while they are ironing, not only stitching. There isn't, to my knowledge, an ironer today in the small wears standing; she is alternating, but she isn't standing. That is true of small aprons and that is true of any small article that is being made. It is not true of a large apron; it is not true of large articles, but it cannot be, and is not, practical because of the reach.

As to the chair back, I think Miss Swartz is just about right as to height and the necessity of a back, but it would be a very great hardship to enforce this standard in the smaller factories, where we have what you call the comfortable seat with the rest, and every seat must have a rest, where they have built the machine so high or the table so high that the rest is required for the feet; but if we have just the round stool, the common round stool that we have in the work shop. It is comfortable and a girl can pull it up to her and use it when she is tired.

CHAIRMAN COPP: We are very sorry indeed to announce that Miss Ida M. Tarbell is not here this afternoon. The officers of this section are happy, too, that she is serving as one of the unemployment conferees in Washington, and we are gratified to know that she is there in the interests of the woman workers in this country.

We are fortunate, however, in having a short message from Miss Tarbell, which is to be read by a woman who has for several years been engaged in industrial service work, Mrs. Hildred M. Hawkins, of the National Enameling and Stamping Company, Baltimore.

WOMEN, A NEW FORCE IN INDUSTRY

MISS IDA TARBELL, NEW YORK CITY

(*Abstract*)

I am not here to talk about the new area of work which women in the war added to that already held; nor about their evolution as executives, instructors and foremen; nor about the new industrial professions that they are developing, such as nurse, employment manager, industrial consultant—but rather to suggest to this section of the National Safety Council that it consider the possibility of rallying to the work of

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the Council a great body of women entirely outside of industry itself but responsive to appeals for public service, and many of them organized in such a way as to focus power and influence quickly on tasks which appeal to their imaginations and to their hearts.

The work of the National Safety Council cannot be confined longer to the narrow limits of industry itself. It is more and more obvious that public safety must be included in its range of activities. Its experience, the technique it has worked out, its knowledge of how safety is achieved through organization and education as well as safeguards, should be made available somehow in attacking the awful waste of life and limb—a destruction like that of war—which goes on all the time in this country.

The psychological effect of the present indifference to safety in our streets and on our highways cannot be ignored by industry. The wanton recklessness of the road dulls the attention and interest of the industrial workers, puts a premium on "taking a chance"—care becomes out of fashion as a bicycle—recklessness as popular as an automobile. That is, public safety is the direct concern of industrial safety. The latter cannot acomplish its ends as long as the mental attitude it needs for its work is constantly weakened by wanton indifference to the former.

Not only will the thing for which the Council has been created—industrial safety—be advanced by work for public safety, but your man in industry who understands the principles of safety, will have an opportunity to serve the public in a way greatly to his advantage, that is, the worker at his machine, through safety organization, has attained a knowledge of the safety problem and the way to solve it which the ordinary citizen has not, and it would be a fine thing for the workers of this country, isolated as they so often are, from public service, not through a desire to shirk but not knowing how they can definitely help. if they could carry to the public what they have learned in the shop.

Granting all this, accepting that there is an obligation on the Council to use its vantage point to teach in the matter for a public service, the woman power of the country must be enlisted. I do not know a finer job for this section than to go after the women, particularly organized women.

THERE ARE SPECIAL PROBLEMS IN CONNECTION WITH THE EMPLOYMENT OF WOMEN IN INDUSTRY

I understand the feeling of certain women that a Women In Industry Section is what you may call a throw-back, that women should be taken into the Safety Council not as women at all, but as industrial workers, regardless of sex. We have a long way to go socially and industrially in this world before women will cease to be differentiated from men in all activities. Mother Nature will have to undo her work entirely before there will be no special problems connected with women wherever you meet them. It is the business of this section to handle whatever there is special in the problem, whether it is the best method of getting the obstinate girl at a dangerous machine to wear her cap,

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or having persuaded her to wear it, to keep her bangs tucked in; or whether it is the big and definite problem that I am suggesting, enlisting the women of the country, organized and unorganized, in a public safety campaign.

It is something of a job. And if it had not been for our experience with women's organizations in the war I should not feel hopeful about it. That experience convinced me that the woman power of the country can be mobilized for permanent safety work, if this section will lead the way. Through the women's committees formed by the order of the government at the beginning of the war, practically all of the great national women's organizations were rallied to the support of war enterprises. It was the most remarkable co-operative undertaking that has ever been carried out by American women. The organized woman power of every state in the union was so pooled that you could throw it in this or that direction at a notice of in some cases not over twenty-four hours. One section of the government's work concerned itself with women in industry. Thousands of women interested themselves in the carrying out of the regulations governing women's industrial war work, who, by their own confession, had never in their lives before been in a factory, scarcely knew that there were such things as industrial problems. The war ended their activities but not their interest, for in some cases the work that they inaugurated is still going on, and the effect of the education which they received cannot be computed.

PUBLIC SAFETY AS A FIELD FOR WOMEN

Suppose that this section was able to rally in each state to the work of industrial and public safety all of the great women's organized associations, to persuade them to take up this work as a permanent interest, what a power we would have behind the National Safety Council! Properly put to them, they would rise to it like a fish to a fly. It is their kind of thing.

If this Council is going into public safety work, as I most certainly believe it is its duty to do, passing on to the public its splendid enperience and achievement, it is going to need the women. And it ought to be the business of this section to help to capture them for this enterprise.

DISCUSSION

Miss Nesta C. Edwards: I wonder if this would not be the time and place to speak regarding Miss Tarbell. Many of you may be interested to know that she today has been called to Washington on the President's commission which is considering the important question of the unemployed; and I wonder if it wouldn't be the proper thing for this group to send some word of expression to Miss Tarbell of our appreciation of what she has done for the cause of safety. From the very start of the history of the National Safety Council, Miss Tarbell has stood out conspicuously as a woman who has devoted heart and soul and brain to the furthering of the safety movement. She has been most generous in her time, both by way of speech and with her pen.

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I know of no woman today in the United States who has had the keen interest and who has so marvelously put forth to so many people, both employer and employee, the things which are most needful, most helpful and most valuable to both great forces; and therefore I am going to suggest that we rise, as an expression, in order that the secretary may make that note to send some form of greeting to Miss Tarbell.

(All present arose and applauded.)

Miss Ethel M. Johnson, Assistant Commissioner of the Massachusetts Department of Labor and Industries, will now discuss Miss Tarbell's paper.

MISS ETHEL M. JOHNSON (Boston): Miss Tarbell has placed a large order upon the women's organizations, but it is one which I am sure they will be glad to endeavor to undertake.

In connection with Miss Tarbell's proposal to enlist the women's societies for safety work, I should like to suggest some of the ways in which women may assist in promoting industrial safety. It isn't necessary to try to say what form of safety work is most important. The fact that a larger number of people are killed by automobiles than by disasters in factories is no reason for in any way relaxing our efforts to make industry a safer place for employees; and in this connection we need to bear in mind that the fatalities represent only a very small fraction of the total number of accidents in industry. For example, although the number of deaths caused by industrial accidents in this state last year was approximately 370 as compared with 480 caused by automobiles during the same period, the total number of reported accidents in the State during the year was nearly 200,000, while the number of accidents caused by automobiles was only 21,000. It is true that a great many industrial accidents are of a minor nature, but of the total reported, nearly one-third, 64,000, are what are called tabulatable injuries. Of the accidents reported last year, approximately 1,600 resulted in permanent partial disability. We haven't available figures to compare the number of accidents of that nature in industry with the number of similar accidents outside of industry, but it is said, I think, that non-fatal accidents are more numerous in industry than elsewhere, so far as resulting in some form of permanent injury is concerned.

WOMEN CAN HELP IN REDUCING ACCIDENTS TO WORKING CHILDREN

In spite of all of the safeguards that we try to place around the young children in industry, there were last year 90 children, from 14 to 16 years of age, who suffered industrial accident, resulting in some form of handicap for life. It is the children, the young children usually, who pay the heaviest toll on the streets In industry it is the adult worker in the prime of life, who is the heaviest sufferer; and these workers usually have dependents, so that their death or permanent injury is a much more serious problem than the figures themselves would indicate.

The great army of women outside of industry, as Miss Tarbell has suggested, can assist in reducing this waste, just as they can assist in reducing the waste on the streets.

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The first requirement here, as elsewhere, is education. In order to prevent accidents, it is necessary to know as much as we can about the causes of the accidents, that the cause may be removed. It isn't enough to say that the accidents are due to carelessness; we need to know whose carelessness was responsible and the reason for the carelessness.

In the case of industrial injury to minors, should we say that the carelessness was that of the irresponsible child, or the carelessness of the employer who permits the child to work where hazards exist? Or was it the carelessness of the school physician who signed the health certificate for the child, perhaps without making an examination or without knowing anything about the dangers connected with the employment for which the certificate was issued? Or should we go further and say that the carelessness is that of the community in permitting children to go to work at an early age, without instruction as to industrial hazards and without adequate supervision after they are in industry?

Not long ago a boy of fourteen, employed in one of the factories in this state, was crushed to death between the carriage and breast-beam of a spindle-wheel. In that case, should we say that it was the carelessness of the child, who did not understand the danger of traversing machinery, or shall we say that in the last analysis of the carelessness was that of society in permitting young children to be employed on work involving such a risk? According to the inspector's report, there was apparently no legal wrong committed in this instance. The Massachusetts laws does not prohibit the employment of children of this age as back boys on mules, but surely there was responsibility somewhere for the loss of that child's life.

Much of what we call carelessness is really ignorance—it may be ignorance of a foreign-born worker who does not speak the language and fails to understand the instructions given, or it may be ignorance as to the mechanism of the machinery, due perhaps to the fact that the schools have failed to give instructions, or more directly to the failure on the part of the management to see that every employee is given instruction not only in the operation of his machine, but in its *safe* operation.

There are other causes of carelessness resulting in accidents. They have been touched upon by Mrs. Gilbreth and Miss Swartz. It would be interesting to know, if we could, how many of the cases of inattention, resulting in accident, were due to fatigue induced by long hours or monotonous work unbroken by rest periods, to eye strain caused by faulty lighting. It has been estimated by an insurance expert that, of the total number of industrial accidents, fifteen per cent are due to inadequate or faulty factory lighting.

CONTRIBUTORY CAUSES OF ACCIDENTS IMPORTANT

We are apt to overemphasize the immediate causes of accidents and give too little attention to the contributing causes, such as bad working conditions, overcrowded, insanitary and poorly lighted work-rooms, or bad working practices such as running machines at so high speed that employees have difficulty in keeping pace and have no time to think of

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safety. We need more studies dealing with the causes, both the direct and the indirect causes of accidents.

We have in Massachusetts, I regret to say, very little information about the accidents occurring to women in industry. We know that there were last year about 7,000 women who suffered industrial accidents of some nature; that presumably the reported accidents were more than twice that number, and that is about all. We need also more information regarding the causes of accidents to children, in order that there may be a sound basis for revising the list of prohibitive employments for minors. In Massachusetts the list was made up a number of years ago and during the war children have entered many new occupations and new processes which would seem to make it advisable that the list should be revised. The fact that such an accident as I just referred to, could occur, and could legally occur, indicates the need for such action and such study and the need for such legislation.

There ought to be more instruction in evening schools, in the settlement houses, for workers, and in the grade schools, to reach the children before they go into industry, and through the vocational counsellors, the school physicians and the placement officers, to reach the children as they are going into industry. The women's organizations can help materially in stimulating this work; they can acquaint themselves with what is being done and with what ought to be done; they can urge that more studies be made of the contributing causes of accidents; that more time, for example, be given to investigating the conditions of employment of women and children, and that the results of those studies shall be published, so that they will be available to all who are interested. They can help also in supporting the legislation introduced by their labor department or by private agencies in their states, for the protection of the health and safety of employees.

I have emphasized particularly the work that women can do in promoting industrial safety because that is the form of Safety work in which the Department of Labor is directly concerned and because so large a number of accidents occurring are industrial accidents. The essential principles of safety are the same, and to a large extent the same agencies can be utilized in promoting industrial safety as in promoting public safety, and if any organization of women is formed for public safety work, it would seem desirable that a considerable part of the time should be devoted to the problems of industrial safety.

MISS SWARTZ: I simply want to rise to defend my seat. Apparently both the speakers who condemned the saddle shaped seat (Miss O'Sullivan and Capt. White) think I meant the kind of seat that they have on the mowing-machines, you know, out on the farm.

MISS O'SULLIVAN: No, I didn't.

MISS SWARTZ: I am sorry I haven't enough reports to go around, but I wish to give these two friends that I am trying to convert to the saddle shaped seat, pictures of the kind of chair that I refer to, so that they can take it home and sleep over it until the morning, and perhaps they will be converted to it.

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(Miss Swartz handed Captain White the picture.)

CAPTAIN WHITE: That is improper because it isn't parallel to the floor; it raises the knees and catches the leg right under the thick part of the leg.

MISS SWARTZ: It is round edged.

CAPTAIN WHITE: Way back in the time of the pyramids people sat down; and you see them sitting there still; they have been sitting for three or four thousand years; and they sat on seats that were parallel to the floor, with their legs out straight with the proper posture. They were educated men at that time, and they have had that experience.

MISS SWARTZ: I am only a lay person and don't pretend to know what is physiologically correct. That chair that I was describing this afternoon is one that has been worked on by physicians and surgeons and by such men as Dr. Goldthwaite and Dr. Spaeth of Johns Hopkins, and they have decided it to be the right thing, and I don't pretend to know whether they are right or not, but I respect their judgment enough to think that they are right, and that physiologically that chair seat is correct.

DR. SCHRAM (Fairbanks-Morse Company, Beloit, Wis.): I question very much the idea that because back in the dim ages they sat on a flat surface, that a flat surface fits the place nature designed, on which you sit now.

For years we have used shoes that have been ruinous to our feet. A few of the shoe companies at the present time are building a foundation under our feet that is worth while, and that is not a flat surface. We went barefooted for a long time back, when our ancestors possibly were throwing cocoanuts at each other, and we walked on flat surfaces and it helped us; but when we put on shoes, we should not use a flat surface on which to walk and bind the foot up in that, any more than we should try to sit down on a perfectly flat surface with a perfectly straight back and expect that to fit our thighs, our hips and our back.

DR. A. W. COLCORD (Carnegie Steel Company, Clairton, Pa.): In regard to the chair, I don't feel competent to answer those questions. I listened to Dr. Goldthwaite last June here in Boston; I saw his chair; I saw him demonstrate it, and I was converted to Dr. Goldthwaite's idea—the chair that Miss Swartz described. I am sorry that one was not brought here. I would have liked to have you see that chair.

I believe especially the point that Dr. Goldthwaite emphasized more than anything else was the shortness of the chair; the chair was short, so that in sitting down the person didn't slump down; in fact, there was no room to do it. As he said, they assumed the correct position and they couldn't sit any other way.

As I understand it, these chairs have been introduced in a number of department stores in Boston. A surgeon who has charge of the surgical work of several department stores in Boston said that he had succeeded in getting those chairs introduced in those stores. He also said that the people who made them had not been making them in quan-

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tities before; they had only made sample chairs, but that lately they have offered to make them in quantities and offer them for sale.

ADJOURNMENT.

ELECTION OF OFFICERS

At the business session of the Women in Industry Section held Thursday, September 29, 1921, the following officers were elected to serve the ensuing year:

Chairman: Miss Tracy Copp, Special Agent on Industrial Rehabilitation, Federal Board of Vocational Education, Washington, D. C.

Vice-Chairman: Miss Laura M. Roadifer, Safety Instructor, Philadelphia Rapid Transit Company, Philadelphia.

Secretary: Mrs. Hildred M. Hawkins, Service Worker, National Enameling and Stamping Company, Baltimore.

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Woodworking Section

September 27, 28 and 30, 1921

E. ROSS FARRA, Chairman
American Car and Foundry Company, Wilmington, Del.

F. G. LOVETT, Vice-Chairman
Industrial Accident Prevention Association of Ontario, Toronto, Canada.

F. A. BARKER, Secretary
Lumbermen's Mutual Casualty Insurance Company, Chicago

TUESDAY MORNING SESSION

THE officers being absent, the meeting was called to order by the chairman of the program committee, Mr. Walter S. Paine, Research Engineer, Aetna Life Insurance Company, Hartford, Conn. He appointed as secretary pro tem, Mr. James T. Haviland, Lumbermen's Mutual Casualty Company, Philadelphia. Reports of the chairman and secretary were read and approved.

On motion it was decided that the Woodworking Section will be responsible for all bulletins of the Woodworking Series, published by the National Safety Council. The following were appointed as members of the nominating committee: Mr. R. McA. Keown, Mr. G. E. Sanford and Mr. W. Dean Keefer.

ORGANIZING FOR SAFETY IN A WOODWORKING PLANT

HARRY GUILBERT, MANAGER, SAFETY AND SERVICE DEPARTMENT, HASKELL AND BARKER CAR COMPANY, MICHIGAN CITY, IND.

(ABSTRACT)

Mr. Guilbert expressed the opinion that there is practically no difference between organizing for safety in a woodworking plant and in a plant of any other industry. He outlined the duties of the central safety committee, the foremen's safety committee, and the workmen's safety committees, describing their activities in much the same way as they are discussed in the Council's Safe Practices pamphlet No. 42 on "Industrial Safety Organization." The mechanical safe-guarding of all moving parts

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was awarded as an essential in all woodworking plants, and the necessity of plenty of light and room—particularly around machines—was emphasized. The speaker then pointed out the necessity for safety education, giving the following figures to prove that mechanical guards, though necessary, will prevent only a small percentage of the accidental injuries in a woodworking plant. These figures are descriptive of the 303 accidents which happened in the planing mill of the Haskell and Barker Car Company during the years 1917, 1918, 1919 and 1920.

Number of Accidents	Per Cent	Causes
66	21.78	Falling material
56	18.48	Splinters
41	13.53	Caught between material
20	6.60	Falls
20	6.60	Caught between trucks
18	5.94	Caught between material and machinery
15	4.95	Cut on tools
14	4.62	Cut on knife
13	4.29	Cut on saw
11	3.63	Caught on boring bit
8	2.65	Strains
5	1.65	Caught between truck and lumber
5	1.65	Struck hand or part of body against something
5	1.65	Projecting nails
3	.99	Broken belt
1	.33	Struck by belt
1	.33	Saw counterweight fell
1	.33	Belt and pulley

Mr. Guilbert stated that in 1917, before organizing for safety, the men in the planing mill lost 3,220 hours because of accidents. In 1920 they lost 810 hours. The wood mill men lost 4,441 hours in 1917, and only 791 hours in 1920. An analysis of the situation indicated that many accidents in this plant could be prevented by relieving congestion and by the proper routing of trucks.

DISCUSSION

Mr. Harden (Massachusetts State Insurance Department, Boston): How many men do you employ?

Mr. Guilbert: We employ a total of about 2,500 men; about 500 ar engaged in woodworking.

SAFETY EFFICIENCY IN RELATION TO WOODWORKING PLANTS

William C. Chesworth, District Sales Manager, J. A. Fay and Egan Company, Boston

(In Mr. Chesworth's absence, his paper was read by Mr. F. F. Fox, Supervising Safety Engineer, Aetna Life Insurance Company, Hartford, Conn.)

The causes of accidents in woodworking plants come under two heads: First, the indifference of the operator. He may, by constantly using a machine, become careless, and pay the penalty by losing a limb. And second, the indifference of the foreman. His indifference will make indifferent, careless men. If, however, he believes in safety and by what

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he says and does convinces his men that he is in earnest and is doing everything in his power to protect them, they will think and act with him. Just as the corporal determines the morale of a military company, so the foreman determines the spirit of safety in his department.

The foreman must believe in accident prevention just as he believes in everything else that prevents waste and increases the efficiency of the department. It is highly desirable that the foreman get his men intelligently interested in safety, that he keep close to them, watch their habits, study their jobs, and carefully instruct them in accident prevention. This is especially true in the case of the new men. He should tell them to be careful and warn them in regard to the particular hazards of their jobs; giving them specific instructions as to the safe methods of working. Some foremen really do not believe in safety. They have not awakened to the fact that keeping their men from being injured and out of trouble is efficiency. Such a foreman never gets his men to take safety seriously. I believe that the foreman always sets the pace.

SAFEGUARDS

1. A safeguard should be so designed and constructed that it will prevent all accidents from the part guarded to the operator while at his regular work, and also to the other operators or passers-by should they slip, or fall, or carelessly touch the machine.
2. The guard should not interfere with efficiency or production. If it does, it is likely to be taken off. In designing a guard, it is wise to consult the man who is to use it.
3. The guarded part must be easily accessible for oiling, inspection, and repair.
4. The guard should be attached to the machine, not to the floor.
5. If it is necessary to have a removable section, this section should be hinged or attached to the remainder of the guard on the machine. If this is not done, the guard is apt to be left off of the machine permanently. The guard should not interfere with cleaning or sweeping on top or around the machine.
6. The guard should be strong enough to resist warping and hold its shape. A light flimsy guard soon becomes bent and is discarded.
7. Wooden guards becoming soaked with oil are a serious fire hazard. Metal guards are preferable, being neater, wearing better, etc.
8. Guards may be made of cast iron, sheet metal, wire mesh, and of expanded or perforated metal or slats. In many instances, perforated aluminum guards are very desirable, being light and strong.
9. A safeguard may be designed so as to prevent wear on the part guarded. For instance, a solid gear enclosure adds very much to its life.

The following are a few typical guards embodying these principles:

A—Circular saw guard

1. Every circular saw should have a hood guard
2. Guard should be automatically adjustable
3. Every rip saw guard should have a splitter.

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B—Jointer guard

1. Only circular safety head should be used
2. The guard should cover the head at all times, except that portion of the head that is covered by the stock.

C—Shaper guard

1. Shaper heads should be guarded
2. Exhaust hoods should be used on all woodworking tools
3. All boring bits should be guarded, preferably by perforated aluminum guards.

Ladders are a good example of woodworking equipment which should be safeguarded. The ladder itself must be strong enough to carry the heaviest man likely to use it. Home-made ladders require special attention, because they are likely to be poorly put together, or to contain defective material. Portable ladders should be equipped with anti-slip bases of a type suited to the floor on which the ladder is used. For rough floors, the anti-slip bases may be metal points or lead coated bases. For concrete floors, they may be lead or carborundum. Before attaching an anti-slip base or shoe to a ladder, it should be tested on the floor on which it is to be used to make sure that it will not slip.

EYE PROTECTION

Eye injuries were, and still are, very common in many kinds of work, and to prevent them is one of the first efforts in the interest of accident prevention. The first eye protectors were ordinary spectacles, but these were soon found to be inadequate. Then came spectacles with side shields. Later improvements in the size and strength of the lenses were made, and the frame strengthened, and the temples made more comfortable. As a result, goggles fitting with a fair degree of comfort now protect the eyes from flying objects, whether these are minute dust particles, or larger and heavier objects, like chips of steel. Lenses can be secured which, excepting under extraordinary circumstances, will not fly into the eye when broken.

FLOORS

The floor should be positively non-slippery at such machines as irregular molders and band saws. A sheet of lead, a rubber mat or some other anti-slip surface, should be placed on the floor. This prevents accidents and greatly increases the efficiency of the workmen. Sufficient space to permit the operator to care for all parts should be left around the machines.

FIRST-AID

First-aid has two purposes:

1. To care for an injury so that the danger to life and the loss of time are reduced to a minimum.
2. To make the patient as comfortable as possible until the arrival of the doctor.

Whenever first-aid is given, the person administering it should clearly understand that the treatment is only temporary, and the injury should

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be examined and redressed by a doctor at the earliest possible moment. One of the best indications of the value of first-aid is the frequent prevention of infection. Although it is neither difficult nor expensive to prevent or control infection, state reports indicate that nearly 10 per cent of all workmen's compensation cases are due to infection. In administering first-aid, the action which resulted in the injury should not be criticised, but an attempt should be made to secure a true statement of the actual causes of the accident. Opportunity offering, the injured employee may be encouraged to tell how the accident could have been prevented by him.

The first-aid kit for employees working at isolated points should be small and compact. It is desirable that these employees be taught elementary first-aid. The Red Cross method or some other method approved by the company's physician should be used. A simple first-aid kit, which may be contained in a metal box, should consist of the following:

1. Instruction book
2. Six ampoules (vaporoles) containing 3½ per cent iodine (small size)
3. Box of toothpicks
4. Two one-half ounce packages absorbent cotton
5. Two one-yard cartons sterile gauze
6. Ten yard spool one-half inch adhesive tape
7. Pair of scissors (three-inch blade)
8. Two rolls of one-inch and one roll of two and three-inch bandages (ten-yard)
9. Three triangular bandages
10. Three-ounce collapsible tube of sterile petrolatum (or similar ointment for use in treatment of burns).

DISCUSSION OF MR. CHESWORTH'S PAPER

F. F. Fox, Supervising Safety Engineer, Aetna Life Insurance Company, Hartford, Conn.

Mr. Chesworth mentions the indifference of the foremen as one of two accident causes. It is presumed that his intention was to include the indifference of the management, for my experience has been that the attitude of the management is usually reflected in the foremen just as the foremen's attitude is reflected in his men. Occasionally you will find the exception; that is, the foreman who is interested in safety and anxious to do everything possible to prevent accidents in his department, but he is handicapped by the indifference of his superior. This indifference may be shown by failure to replace machinery so obsolete or defective as to be dangerous; failure to provide the necessary guards or sufficient light to perform properly and safely the work of the department. However, this condition is the exception, and an indifferent foreman usually signifies an indifferent management. The point I wish to make is that the

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attitude of the management toward accident prevention work is the factor which determines the foreman's attitude and the results obtained.

The fact that some foremen do not realize the loss in efficiency caused by accidents in their departments is brought out by Mr. Chesworth. In this relationship of accidents and efficiency, I should like to present a thought originating, I believe, with Mr. S. J. Williams, of the National Safety Council, to the effect that some accidents have a value since they direct attention to inefficient practices. Permit me to quote briefly from Mr. Williams' article:

"The second class of accidents includes those cases where a person is normally and necessarily in proximity to some machine or operation, and is injured by some abnormal or accidental behavior of the machine or operation; example—a punch press operator who finds it necessary to reach into the press to remove material which has become stuck, and has his finger cut off by the unexpected descent of the plunger; a box falling from a loaded truck when the truck strikes a rough place in the road.

"It is at once apparent that accidental injuries of this class involve or coincide with inefficiency. Furthermore, the inefficiency is not limited to the comparatively few cases where a personal injury results; the punch press operator may reach into the press a thousand times to remove the article which is stuck without losing his finger, yet each one of these thousand times he loses a moment and his efficiency is decreased. The object falling from the loaded truck may not hit anyone, but the occurrence represents inefficiency because, at the least, someone must stop and pick up the object, and the latter in addition will be more or less damaged. In other words, we are now considering accidents in the larger sense—according to the Standard Dictionary—anything occurring unexpectedly; every such accident denotes inefficiency because it interrupts the orderly progress of production. The occasional personal injury which results is, from the production standpoint, chiefly significant because it draws attention to the thousand other accidents which resulted less seriously to the man, but which caused an appreciable loss of production. From this point of view, it is easy to understand the remarkable increases in production and efficiency that have been recorded from an improvement of operations, the necessity of which was first conceived from the standpoint of the accidental personal injuries occurring thereon."

Mr. Williams clearly proves the relation of safety to efficiency for the class of accidents under discussion, but from all classes of accidents we have a loss of efficiency due to the inability of the injured workman to perform his work, and the demoralizing effect, depending in extent on the seriousness of the accident, on all employees who witness or learn of the accident, resulting in decreased production. Other losses are increased spoilage of materials, greater labor turnover, and increased overhead, but these facts are so universally recognized that no time of this meeting need be taken with a discussion of them.

In describing safeguards for the circular saw, jointer and shaper, Mr. Chesworth has selected the machines which cause a large percentage of

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the serious accidents in a woodworking plant. The list might be amplified to include every woodworking machine, but this hardly seems necessary since tomorrow's program for this section provides for consideration of a proposed code for the safeguarding of woodworking plants and deals with this subject in detail.

This code also covers the various allied subjects which have an important bearing on accident prevention, such as arrangement of machine, lighting, aisleways, storage and piling of materials, floors, exhaust systems, self-feeds for machines, etc., so that all discussion in these matters can very properly be omitted from this paper.

Mr. Chesworth has thoroughly covered the subject of first-aid treatment for injuries and this is of the greatest importance in woodworking plants. Splinter or puncture wounds are always particularly susceptible to infection since it is difficult to cleanse the wound properly, and a competent first-aid attendant is essential in any woodworking plant. Not only should he know how to treat wounds, but he must be capable of using good judgment in determining those cases which should be referred to a physician for redressing in order to reduce the possibility of infection to a minimum.

DISCUSSION

MR. J. S. MANN (Crompton and Knowles Loom Works, Worcester, Mass.): Is there any good saw guard made that does not obstruct the view of the operator?

MR. CHESWORTH: I don't think you ought to have any trouble with any standard guard on a splitting saw where the saw table is horizontal.

MR. MANN: They obstruct the man's view of his fingers when he is working close. I have always felt that the best saw guard was a good sharp saw and a spreader at the back of the saw.

CHAIRMAN PAINE: Last year we had a discussion on that point by Mr. Schreiber, of the Wisconsin Industrial Commission, who has spent over fifty years in the woodworking industry. He thinks that in addition to having the saw properly sharpened, set, and in good working condition in most cases a saw guard could be very effectively used. You can get a copy of his paper from the National Safety Council.

DESIGNING WOODWORKING MACHINERY TO PROVIDE THE HIGHEST DEGREE OF SAFETY

R. McA. KEOWN, ENGINEER, INDUSTRIAL COMMISSION OF WISCONSIN, MADISON, WIS.

The following figures, representing the experience of Wiscinsin manufacturers during the six years from 1915 to 1920, prove that woodworking machinery is responsible for a large percentage of the number of injuries and amount of time lost due to machinery accidents:

Class of machinery	Number of injuries	Per cent	Deaths	Per cent	Days lost	Per cent
All machinery	17,984	100.0	124	100.0	3,585,728	100.0
Woodworking group	5,313	29.7	25	20.2	1,053,719	29.3
Saw accidents	3,319	18.5	18	14.5	663,010	18.5

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Woodworking machinery was responsible for about 30 per cent of the number of injuries and days lost on all machinery injuries. Saws were the principal producers of injuries and lost time. In the woodworking group, saws were responsible for about 63 per cent of the number of injuries and days lost and 72 per cent of the number of deaths. These figures, representing the experience of only one state, ought to convince the most skeptical that a great deal remains to be done along the line of safeguarding woodworking machinery.

PROGRESS IN GUARDING WOODWORKING MACHINERY HAS BEEN SLOW

It is interesting to peruse the pages of old catalogues of woodworking machinery issued thirty years ago and study the illustrations. They show very little in the way of safeguards, but here and there a splitter may be seen and occasionally a partial guard for gears. And then, by contrast, turn to the present day catalogues and see what progress has been made. Judging from the illustrations, the majority of these catalogues indicate but little progress in safeguarding since 1880. On the other hand, a few manufacturers have catalogues which show machinery with well designed guards in place. The latter class of manufacturers are entitled to a great deal of credit for this progress, but even the most advanced designers of woodworking machinery have not yet provided the highest degree of safety attainable in their product.

SAFETY REQUIRES GUARDING

It is thoroughly agreed that safeguarding of woodworking machinery is a necessity, but there is considerable difference of opinion as to who should do the safeguarding. Some claim that this should be done by the machinery manufacturers; others maintain that safeguards are "extras" and should therefore be provided by the user. Our experience leads us to believe that it is highly desirable to install all guards in the plant of the machinery manufacturer.

REASONS WHY MANUFACTURERS SHOULD GUARD MACHINERY

It is easy to appreciate the situation in which an employer finds himself when told by an inspector that the machine he has just purchased, and which was supposedly the last word in woodworking machinery, does not comply with the law. The employer must then purchase "extras". He can buy one of the many standard guards that are offered for sale, but the one he has selected may not be satisfactory for his particular machine and the work it must do. Then he may try another guard and still another and finally conclude that guards are impracticable, throw them away and go ahead without any at all. There are some operations in woodworking plants which present hazards for which the guards that can be purchased in the market are not adaptable and cannot be used. In such a case the owner may try to procure a guard locally, but the expense is usually much greater than if the guard had been included in the design. Home-made guards are apt to be cumbersome because it may be difficult

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to secure proper tools or materials for fabricating them. They usually take up too much space and may cut off considerable light from the point where it is desirable to have plenty of illumination.

Many accident reports state that guards were provided, but were not in use at the time the accident happened. This is often because the safeguards were afterthoughts and perhaps makeshifts which were not adapted to the machines or to the operations.

Where a guard is added to a machine after it comes from the factory, the operator is likely to feel that it is unnecessary, for if it were necessary it would have been provided by the manufacturer in the first place. When the machine comes from the factory equipped with an adequate guard, the operator is more likely to conclude that it is a necessary part of the machine.

STANDARD WOODWORKING SAFETY CODE

Manufacturers try to justify their policy of selling unguarded woodworking machinery on the ground that this machinery may be sold in any state of the union, some of which have different, and in some instances, conflicting safety standards. At the present time considerable progress has been made in drawing up a Woodworking Safety Code which it is hoped will eventually be adopted by all states. The adoption of such a uniform code by the various states will go a long way towards removing this argument of the manufacturer.

MARKETING POLICY CONTRIBUTING TOWARD SAFER DESIGNS

It is reported that one large builder of woodworking machinery adheres to the policy of refusing to sell his product unless it is equipped with all the necessary safety appliances, and that this firm will not quote a price except for a completely guarded machine. There is also one Wisconsin jobbing house that will not handle machinery that is not properly safeguarded. It would be a great thing if other manufacturers and jobbers would follow similar marketing policies.

LEGISLATION AS A FACTOR CALLING FOR SAFER DESIGN

In the Wisconsin 1921 legislature a bill was introduced which, if passed, would have provided that "no machine, mechanical device, or steam boiler shall be sold or exposed for sale or installed or delivered for use which does not fully comply with the requirements of the laws of this State enacted for the safety of employees and frequenters in places of employment and public buildings and with the Orders of the Industrial Commission adopted and published in conformity with the statutes." Had this bill passed in the form in which it was originally submitted, violations of these provisions would have made the vendor liable to the purchaser for double any loss sustained by reason of such violation including the cost of equipping the machinery as required by the laws of the state and the orders of the industrial commission supplementary thereto. While the bill did not pass in its original form, it did pass in an amended form and became Chapter 262, Laws of 1921. It reads as follows:

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"Section 2394-72. No machine, mechanical device or steam boiler shall be installed or used in this state which does not fully comply with the requirements of the laws of this state enacted for the safety of employees and frequenters in places of employment and public buildings and with the orders of the industrial commission adopted and published in conformity with Section 2394-41 to 2394-70, inclusive, of the statutes. Any person, firm, or corporation, violating the provisions of this Act shall be subject to the forfeitures provided in Section 2394-60 and 2394-70 of the statutes."

From this it may be noted that no machine which does not fully comply with the requirements of the laws of this state shall be installed or used in this state. The time when laws will prohibit the sale and the delivery of unguarded machines may not be so far off. The effect of legislation of this kind will be to put the matter of providing adequate safety devices for woodworking machinery directly up to the designers.

CONSULT THE SAFETY ENGINEER

It would seem desirable to have a safety engineer on the designing staff of the manufacturer. His knowledge of accidents and how they occur, gained by actual experience in accident prevention work, would be a valuable asset. Then too, the purchaser of new woodworking machinery should consult with his own safety engineer when he is about to buy new apparatus. The safety man can often point out the accident hazards of machines offered for sale.

SAFETY SPECIFICATIONS

The purchaser should draw up safety specifications, send them out with all inquiries for bids, and then insist that the manufacturer meet these specifications. These safety specifications might include such general safety items as: "All gears shall be completely enclosed with substantial cast iron or sheet metal covers so designed as to make the parts within readily accessible for repairs." "All couplings, set screws, keys, bolts, etc., or revolving parts shall be countersunk or covered in such a way as to eliminate danger of accidents." "Unused portions of exposed key-ways shall be filled so as to present smooth surfaces." The common method of guarding pulleys, clutches, chains and sprockets, projecting parts on shafts, rolls and similar hazards, should be stated in the safety specifications. In addition to such general specifications it may be advisable to specify certain specific guards.

STARTING AND STOPPING DEVICES

A number of accidents have occurred because woodworking machinery was not equipped with the proper kind of starting and stopping device within easy reach of the operator. In many plants a number of machines are driven by a single line shaft and the starting and stopping device is often distantly located.

Sometimes the engines or motors are even located in another department or in another building. Where this system is used the prompt stop-

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ping of machinery is impossible in case of emergency. If the controlling device is located at a distance and possibly out of sight, a man might start a machine while it is being repaired. Also, machines are allowed to run idle and accidents occur because the workmen often mistake a rapidly revolving saw or knife head for a stationary one. Therefore, it is extremely important that each woodworking machine should be designed with an adequate belt shifter or other starting and stopping device so as to permit its prompt stopping in case of an emergency. Such control device should be a part of the machine and within easy reach of the operator.

INDIVIDUAL MOTOR DRIVE

Individual motors eliminate belts, pulleys, and line shafts and improve illumination. In addition, machines may be placed wherever desired without having limitations imposed by shafting. Crowding of machines and workmen is avoided. The absence of shafting and belting affords clear space and aids in the safe handling of material. Belt shifting is eliminated. In case of emergencies, quick stops are possible and unexpected starting of machinery can be prevented by locking switches. However, if electric motors are used, certain electrical hazards are introduced. If the motor and controlling devices are built into the machine as an integral part, the designer should see to it that all current carrying parts are completely enclosed, and that all non-current carrying parts are adequately grounded.

AUTOMATIC FEED ROLLS AND CHAINS

Many machines are equipped with automatic feed rolls. The theory is that if material is fed automatically it will be unnecessary for the operator to bring his hands near the point of operation. But this sometimes introduces an additional hazard, that of the operator having his fingers caught at the "pinch point" of the feed roll and the material. Suitable guards for the pinch point should be provided by the manufacturer.

The feed chains of certain types of edge ripping, jointing, and tenoning machines present a pinch hazard at the point where the links come together. This is particularly true where the feed chain passes over the end sprocket. In making the end turn over the sprocket the joints open up and when the chain straightens out again they close, thus forming a pinch or clipping hazard for the operator unless covered until the straightening process has been completed. The necessity of building in a protective device against this hazard is apparent.

BUILDING IN EXHAUST HOODS

Woodworking machines throw off dust, chips, splinters, and shavings that should be carried away by properly designed exhaust systems. Exhaust systems prevent injury from flying particles and make it unnecessary for the operators to risk losing their fingers by using their hands to brush away accumulated rubbish. Frequently exhaust hoods can also be made to guard the machine's point of operation. Many woodworking ma-

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chines might be improved if the manufacturers would make the exhaust hoods an integral part of the machines.

UNIVERSAL TYPE MACHINES

Universal machines, capable of performing a wide range of work are usually difficult to guard. Guards must be changed, altered, and readjusted as the work varies. It often takes more time to adjust the guards than it takes to do the actual work; the result is that guards are frequently taken off and not used at all. On the other hand, where machines are used for one or two particular operations, it is much easier to guard the point of operation. Wherever possible, therefore, machines should be designed to do one or two specific operations and guards for these operations should be provided by the manufacturer.

PORTABLE BENCH TYPES

Many accidents occur because operators attempt to work pieces of small dimensions on machines which are altogether too large for the jobs in hand. Individual motor-driven and fairly well guarded small-sized bench planers, jointers, circular saws, and band saws are now on the market which supplement the larger machines and handle a class of work which the larger machines were never intended to do. These machines are not only safer when doing small pieces of work, but in many instances the work can be done better, quicker, and more economically, for they eliminate a great deal of work with hand tools.

RE-DESIGNING THE WORKING TOOL

Many accidents happen on saws because the saws are dull and otherwise not in good condition. Dull, improperly sharpened, unevenly set, and cracked saws, and even saws without teeth, are sometimes used for weeks or months without being changed or replaced. Why? Because it is too much of a job to remove the saw from the arbor and substitute a new one. Could some form of clamping device be substituted for the screw device to hold the saw firmly on the mandrel when in operation and to make it easy to remove and replace the saw blades? The same question applies to cutting knives attached to cutting heads. A great forward safety step was taken when round heads were substituted for square heads, and their general use resulted in a great reduction in the severity of accidents on joiners and planers. When round knife heads first came into use the throat was shallow and narrow, but on account of the poorer grades of lumber worked nowadays, woodworking men have been ordering larger throats and the experience of Wisconsin seems to indicate that the severity of accidents is increasing, even on round head cutters. Here is a field deserving some study on the part of designers with a view to designing the cutter heads to attain the greatest degree of safety.

CIRCULAR SAW NEEDS IMPROVEMENT IN DESIGN

The circular saw is by far the most hazardous of all woodworking machinery. The experience of Wisconsin shows that "operating" and

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"throw backs" are responsible for 85 per cent of all injuries on circular saws. Cleaning, adjusting machine or work, loose clothing, oiling, breaking of machine or work, flying particles, starting and stopping, accidental starting, and other miscellaneous causes are responsible for the remaining 15 per cent. If designers of woodworking machinery can provide ways and means for eliminating injuries at the point of operation, and for preventing kick-backs, they will have made great forward strides along the line of obtaining the highest degree of safety.

I wish to state that my thanks are due to one of my colleagues, Mr. F. W. Heuls, for assistance in the preparation of this paper.

DISCUSSION

MR. MANN: How many accidents are there per man in woodworking operations; how does this number compare with similar figures for other industries?

MR. KEOWN: There are no statistics on this point. In Wisconsin, however, there are more operators in the metal-working industry than in the woodworking, and also more accidents. I believe that for the number of operators, there are more accidents in the woodworking industry than in other industries.

MR. MANN: In my experience, we have fewer accidents per man in the woodworking industry than in other industries.

MR. H. P. BARHAM (Stearns Lumber Company, Boston): In Wisconsin you have more saws than you do other machines. Doesn't that account for the percentage of saw accidents being so high? In Massachusetts we have a small number of saws compared with the number of jointers, planers, and other machines, and the percentage of saw accidents here is low.

MR. KEOWN: I believe, however, that we have a greater percentage of saw accidents in Wisconsin compared to the number of saws than we do on other machines. Of course, our statistics do not give us the exact number of machines, so I cannot give you definite information on that point.

ADJOURNMENT.

WEDNESDAY MORNING SESSION

MR. WALTER S. PAINE called the meeting to order.

EXHAUST SYSTEMS FOR WOODWORKING MACHINES

H. M. NICHOLS, MANAGER, CONVEYING AND C. I. FAN DEPARTMENT
B. F. STURTEVANT COMPANY, BOSTON

In woodworking plants a properly designed and well installed exhaust or "blow-pipe" system as it is often called, not only adds to the comfort and safety of the workmen but it can actually be made to pay the manufacturer large dividends on its cost.

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BENEFITS

Modern high speed woodworking machines produce such tremendous quantities of shavings, chips, and sawdust that unless this waste material is removed by a suction system, as fast as it is made, it soon clutters up the machines and surrounding floor space, thus necessitating frequent stops to clean the machines and clear away the piles of refuse. The elimination of this extra labor and the increased production from continuous operation of the machines are two dividend-paying items which the manufacturer obtains from an efficient exhaust system. Also where there is a market for either shavings or sawdust the collector can be arranged to separate these materials automatically so they can be sold. And if there is no market for the refuse it can be automatically delivered to the boilers and used in place of coal for fuel. Then again unless this light and bulky refuse is removed from the building as fast as produced it constitutes an ever present and menacing fire hazard.

Accidents are reduced by keeping the floors and working spaces clear of litter, by preventing injuries from flying chips, and by avoiding the necessity of cleaning the machines while in operation. The removal of the dust which is always irritating and sometimes poisonous, improves the health, efficiency, and production of the workers. Insurance premiums, both fire and liability, are reduced where cleanliness prevails.

GENERAL REQUIREMENTS

However, the exhaust system to show these marked advantages must satisfy certain requirements. In addition to handling both the light dust and heavy refuse—

(1) It should not interfere with the operation of the machine or access to working parts.
(2) Hoods and piping should not obstruct the room or interfere with the movements of the workmen.
(3) The fire risk should not be increased.
(4) Where power is costly it should do the work with a minimum amount of power.
(5) In cold climates it should not remove any more air than necessary from the building.
(6) Where power is cheap, first cost should be low, even if the power to operate is slightly higher.

There are two general types of installations, the central and the group systems. In the central system a single or double fan is located near the center of the shop with a piping system radiating from this central point to the woodworking machines. In the group system, which is sometimes employed where the machines to be served are widely scattered, small individual fans are located at the center of machine groups; the exhaust from the various fans usually being conducted to a single collector. The group arrangement is more difficult to balance than the central, and also the large number of small diameter trunk pipes required show a much

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higher friction loss per foot of length than with the central system where one large main pipe serves a considerable number of machines.

Each installation presents special problems. Certain quantities must be chosen arbitrarily by the designer and the success of the installation depends largely upon his experience and the skill with which he chooses these arbitrary quantities. Before starting a design, it is necessary to know the type of shop, the class of work done, kind of lumber handled, the sizes, types, capacities, and locations of the machines, whether the refuse material will be burned in the furnaces or separated and sold, and whether the system is to be designed for minimum power consumption or minimum first cost. It is therefore necessary that a study be made in the field in order to determine all these points.

The next step is to determine the number and size of connections for each individual machine. While it is possible to set certain general standards, yet in actual practice the sizes are considerably affected by local conditions which the layout man finds in the field, and the designer bases the pipe sizes on his judgment, being guided by his experience and general practice. The size of connections will vary with the quantity of shavings made, kind of lumber, its condition, whether wet or dry, speed of the cutter heads, etc., and while we can give a table of connections which are often used, yet experience will best dictate just what sizes are best for a given job.

The main pipes which vary in diameter, increasing from the dead ends towards the fan, are usually made of such size that the area at any point will be 20 to 25 per cent in excess of the sum of the areas of the branches entering between the point in question and the dead ends of the mains. Floor sweeps, if equipped with efficient blast gates are not included in determining this area.

Another method of determining the size of the main trunks is to figure them so as to keep a given air velocity throughout their length. In planing mill work velocities from 2500 to 5000 feet per minute are used. Velocities commonly employed are:—light shavings and sawdust from dry wood, 2500 to 3000 feet per minute; heavy shavings and sawdust from wet wood, 3000 to 4000 feet per minute; hog waste, pulp chips, and similar materials, 4000 to 500 feet per minute. If a considerable number of machines all discharging into one main should be shut off at the same time, the velocity in the main might be lowered to the point where it would not be sufficient to carry the refuse from the machines still in operation and thus result in clogging the pipes. Accordingly it is sometimes desirable to use velocities higher than the minimum to allow a factor of safety to cover this contingency.

The resistance of a round pipe to the flow of air is inversely proportional to the fifth power of the diameter of the pipe. Therefore, handling a given quantity of air through a larger pipe at a lower velocity decreases the frictional resistance very materially, and correspondingly decreases the horse power required at the fan. Thus it is very desirable to keep the air velocities throughout the system as low as possible, consistent with the major requirement that the refuse must be taken away as fast as made, without clogging the pipes.

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After the size of the main trunk is fixed, an exhaust fan should be chosen with an inlet at least as large as the main pipe to which it is connected. If low power consumption is essential use a larger fan having 25 to 50 per cent greater inlet area. The discharge pipe leading from the fan outlet to the collector is usually made the same diameter as the main suction pipe.

The dust collector should be of ample size for the system. The larger it is, up to reasonable limits, the better will be the separation, the less will be the back pressure, and the less will be the power required. It has been the custom to use a collector whose nominal size is equal to the diameter of the pipe leading to it, but this is not good practice unless consideration is given to the proportions and general dimensions of the collector, since some makes are smaller than others, for a given size number.

The suction required at the hoods varies from 1½ to 5 inches of water, depending upon many factors, such as the relative size of the hoods, condition of the material handled, etc. The volume of air required, resistance of the system, speed and horsepower of the fan, are most easily determined by use of engineering formulæ and tables for friction loss in pipes, flow of air for various pressures, etc.

HOODS

The design and construction of hoods are extremely important since they are required to guide the chips and refuse into the suction pipes and prevent them from falling back into the cutters or flying out into the room. Improper hoods are not always the fault of the blow-pipe men as some machines will be found with old style chip breakers to which proper hoods cannot be applied.

In designing hoods, a principle to keep in mind is to shape them so there will be no eddy currents at the inlet. This can be accomplished by laying them out with the so called "stream line" effect, i. e. the sides of hoods should taper gradually to the pipes so that all abrupt bends are avoided. The hoods should be shaped so that the action of the cutters will assist the exhaust system by discharging the refuse in the direction of the flow of air and toward the throat of the hoods. To be most effective, the hoods should fit the cutter heads as snugly as possible without interfering with the operation of the machine. The hoods must also be arranged so that they can be quickly swung out of the way for adjustment of the cutters.

All top and side head hoods require telescope or slip joints for convenience in changing the cutters. The outside pipe of the slip joint should be heavily reinforced at the bottom with a steel band or malleable iron casting. Movable head connections should be provided with cast iron ball joints in order that the heads may follow the cutters to any position without interfering with the operation of the machine or lessening the suction.

Hoods are usually constructed of galvanized sheet iron, the gauge of which, depending upon the strength and stiffness needed, should never

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be lighter than No. 22. Top and side heads to matchers, moulders, planers, and other heavy machines are usually made of No. 16 or No. 18 iron and for the lighter work 18 to 20 gauge is often used. The exposed edges of all sheet metal hoods should be bound with wire or band iron, not only to give the necessary stiffness, but also to prevent the operator from being cut by the raw edges of the sheets.

With some types of woodworking machines it is impracticable to provide hoods which will catch all of the refuse thrown off, and in such cases floor sweeps are placed near them. Also combination floor sweeps should be attached to the bottom hoods of moulders and similar machines. The floor sweeps should be arranged so that all the material passing through them will be lifted from the floor by suction, thereby avoiding the possibility of large blocks and slivers being swept into them. They should also be equipped with tight fitting dampers or blast gates.

PIPES

The conveyor pipes leading from the hoods to the fan and thence to the collector are commonly made of galvanized iron, the gauge of which varies from No. 24 to No. 14, depending upon the diameter. The piping must be free from dents, fins, and projections of all kinds on which shavings and wood slivers might catch.

All permanent circular joints should be lap-jointed, riveted, and soldered, and all longitudinal joints either grooved and locked, or riveted and soldered. Circular laps should be in the direction of the flow, and piping installed out-of-doors should have the longitudinal laps at the bottom. All pipes passing through roofs require aprons to prevent water leaking into the building.

The main trunks and branch pipes should be as short and straight as possible, strongly supported, with the dead ends capped to permit inspection and cleaning. All branch pipes should join the main at an acute angle, the junctions being at the side or top and never at the bottom of the main. Neither should two branches be placed directly opposite each other. Dampers or blast gates should be installed in each branch pipe. Cleanout openings having suitable covers should be placed in the main suction and discharge pipes as well as in the branches leading from the machines. Either a large cleanout door should be placed in the main suction pipe near the fan inlet or a detachable section of pipe, held in place by lug bands, should be provided.

In some cases, where the piping passes through a fire wall it is desirable to install an automatic fire damper.

Elbows are usually made two gauges heavier than straight pipe of the same diameter, the better to enable them to withstand the additional wear caused by changing the direction of flow. They should preferably have a radius of at least 1½ times the diameter of the pipe.

FANS

The stresses and strains on exhaust fans in woodworking systems are unusually severe as not only light dust, shavings, and sawdust pass

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through them but they are also compelled to stand up under the heavy blows of knots and large wood slivers striking the rotating blast wheels at speeds of over a mile a minute. The fans used for this work are known as planing mill exhausters. Heavy steel plate is the best material for the roundabouts, side plates, and cones, as cast iron has been known to crack under the severe blows which these parts receive. The casings should be well braced with angle iron in order to obtain the necessary stiffness and rigidity. Extremely heavy cast iron hangers, having a wide spread at the base, are necessary to take the belt pull.

There are two methods of driving the fans, belted and direct connected to motor. Belt drive is usually preferable because of its flexibility and the ease with which the speed can be changed to accommodate the system to changed operating conditions or increased capacity.

Where long shavings or stringy materials are handled special non-choking open type blast wheels should always be used.

Double exhausters are installed where headroom is scarce or where the main pipes come from opposite directions. In the latter case elbows and bends are eliminated as the main pipes are run directly to the fan inlets.

DUST COLLECTORS

The centrifugal or "cyclone" type collector is commonly used for separating the shavings and sawdust from the air. In this type of separator the mixture of air and shavings is introduced on a tangent near the cylindrical top of the collector and the whirling motion sets up a centrifugal action causing the comparatively heavy material suspended in the air to be thrown against the side of the separator, from which position it spirals down to the tail piece, while the air escapes through the stack at the center of collector. Special construction is sometimes required for fine dust, also some blow-pipe manufacturers use a special type of collector for furnace feed, the object being to deliver the material to furnaces as uniformly as possible.

Where more than one fan delivers into a single collector a back-pressure valve is required to prevent one fan blowing back through the other in case the second fan should stop for any reason.

Collectors are sometimes arranged in parallel and by means of a percentage valve the refuse can be delivered to either one at will, while the air is distributed to the two.

Special collectors are also furnished for separating sawdust from the shavings.

In most plants where the refuse is used for fuel, it is delivered by gravity directly from the collector to the furnace. The discharge pipe leading from the bottom of the collector is divided and the junction furnished with a switch or valve so arranged that when the material comes too fast for the fires it can be diverted into a reserve bin. The furnace feeder should be hinged where it is attached to the lower end of the discharge pipe in order that it may be disconnected from the furnace when the fan is shut down. Also great care must be taken to provide an absolutely tight switch. Otherwise when discharging refuse

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to the storage bin, fine sawdust will sift through this valve and settle in the furnace feed pipe, and in case the fireman has neglected to disconnect the feeder from the furnace, the flame may flash back following this train of fine sawdust into the dust collector.

Much more attention is being given to the problem covering the economical burning of this refuse than in years past when fuel was so cheap, and special grates, stokers, etc., have been developed, with which considerably better combustion efficiencies are obtained.

Because of its simplicity the exhaust system usually receives but little attention once it is installed. However, to obtain the best results it should be inspected at suitable intervals and necessary adjustments made.

The exhaust fan should be given proper attention the same as any other high speed machine. It must be kept in proper alignment and tightly bolted to its foundation.

Suction hoods which have been removed to adjust the machines should be replaced as soon as the adjustments are completed.

Never start a machine with the blast gate closed, as the slight air leakage past the blast gate may draw the refuse into the pipe and clog it.

Keep all large heavy blocks, knots, slivers, etc., out of the system as far as possible.

Blast gates on connections leading to all idle machines should be closed, up to 25 per cent of the connected area of the trunk line in question. This effects a corresponding saving in power. Do not, however, close more than this number of blast gates unless especially allowed for in the design of the system. Also do not overload the system by ill-advised additions.

The casual observer sees a wood refuse exhaust system in operation and gives little thought to the complicated problems involved in its design. And yet, unless a careful study of these problems has been made by an experienced designer, it is almost a foregone conclusion that the system will not work well, or the power used will be excessive. Only by careful designing based on correct theory and practical experience can that balance between the parts, so necessary for a successful and economical system, be obtained.

FORMULAS AND TABLES FOR COMPUTING EXHAUST SYSTEMS FOR WOODWORKING PLANTS

CUBIC FEET OF AIR HANDLED PER MINUTE THROUGH AVERAGE COLLECTING HOODS

Based on Co-efficient at Orifice of .71 with 10 Per Cent Added for Leakage

Diameter of Connection Pipe, Inches	Maintained Suction—Inches Water Gauge						
	1	1½	2	2½	3	4	5
1½	38	47	54	61	67	76	86
2	68	84	97	108	118	136	153
2½	107	131	161	168	185	214	238
3	153	188	217	243	266	306	343
3½	209	256	296	330	362	418	466
4	273	334	386	431	473	546	609
4½	345	423	488	546	598	690	775
5	427	523	605	676	741	854	955
6	614	751	867	970	1062	1288	1373
7	835	1023	1181	1322	1448	1670	1870
8	1092	1337	1546	1727	1892	2184	2440
9	1381	1694	1953	2184	2387	2762	3091
10	1705	2090	2409	2695	2959	3410	3806

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COLLECTOR RESISTANCE

$$R = C\left(\frac{V}{1000}\right)^2$$

R=the collector resistance in inches of water.

V=air velocity in feet per minutes at collector inlet.

C=a constant whose value depends upon the type and construction of the collector and usually ranges from .1 to .2.

SIZE CONNECTION FOR WOOD WORKING MACHINERY

The following table is intended to give a general idea of the size of connections often used with woodworking machinery. This table, however, should be used only as a guide, as the proper size for a given installation depends upon many factors such as quantity of material, kind of lumber, its condition, whether wet or dry, rate of feed, etc.

TYPE OF MACHINE	DIAMETER OF CONNECTIONS IN INCHES
Circular saws 12" dia.	4
" " 12"-24 dia.	5
" " 12"-40 dia.	6
Band saws blade under 2" wide	4
" " " 2-3" wide	5
" " " 3-4" "	6
" " " 4-5" "	7
" " " 6-7" "	8
Small mortisers	6
Single end tenoners	6
Double end tenoners	7
Double " double head tenoners	10
Planers, matchers, moulders, stickers, jointers, etc.	
With knives 6-10"	5-6
" " 10-20"	6-8
" " 20-30"	6-10
Shapers light work	4-5
Shapers heavy work	8
Spindle carver	4-5
Belt sander belt less than 6" wide	4½
" " " 6-10" "	5
" " " 12-14" "	6
Drum sander 24"	4
" " 30"	5
" " 36"	6
" " 48"	8
" " Over 48"	10
Disc sander 24" dia.	5
" " 26-36" dia.	6
" " 36-48" "	7
Arm sander	4

DISCUSSION

Dr. Lucian W. Chaney (U. S. Bureau of Labor Statistics, Washington, D. C.): In the Woodworking Code, as drafted, we have the following statement: "Size of main pipe where exhaust systems are run to 100 per cent capacity, area of the main suction pipe should be 10 per cent greater than the combined areas of the branch pipes entering it between such points and the tail end of the system. This increase shall be carried proportionately throughout the entire length of the main pipe, but where the system is not run to full capacity, the area of the main suction pipe should not be greater than the combined areas of the branch pipes."

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MR. NICHOLS: There is no objection to that statement, but if the system is to be run at less than full capacity, the pipes should be figured for the minimum capacity. That is to say, if your system is to run at 50 per cent capacity, you should figure for that, but of course the velocities of the main pipe should not drop below the minimum of velocities to carry that material. For an average system that would be between 3,000 and 4,000 feet.

DR. CHANEY: It seems to me that in order to maintain a constant velocity in the different pipes, your main pipe would always have to be not greater than the area of the branch pipes. What is the advantage of an excess in the main pipe?

MR. NICHOLS: The reason that the branch pipes usually have a higher velocity is the fact that they usually are lifting pipes, and it takes more velocity to lift the material than it does to carry it in the horizontal main.

The scientific way to design a system is to figure for velocity, but the practical way is to figure on the basis of sizes.

DR. CHANEY: As a matter of practice, would you make your main pipe always somewhat larger than the combined area of your branches?

MR. NICHOLS: As a general rule (unless you knew that the system was going to work at lower capacity) you would have to make your main pipe equal to your branches, or even less, so as to keep that velocity up in the main. In fact, I have seen a system where they ran a main pipe the whole length of the building, about two feet in diameter; down at the far end they capped it, put in about six inch branches. It made a very nice collector down at that end. These little branches came up and dumped all the stuff into that pipe and there it stopped.

HOW CAN WOODWORKING GUARDS BE KEPT IN PLACE

G. E. SANFORD, SAFETY ENGINEER, GENERAL ELECTRIC COMPANY, WEST LYNN, MASS.

(*Mr. Sanford's paper was illustrated with slides.*)

If my subject had been changed slightly to "why woodworking safeguards are not kept in place," I think it would be much easier to handle. In many cases the woodworking safeguard is purchased by a purchasing agent who doesn't know much more about the guard than he sees in a well illustrated catalog, or some new man comes on a job and wants to make a good showing and he purchases a few guards, only to find later that they are not used.

That was the experience of a friend of mine who was interested as a health officer. He was put in charge of the welfare and safety work of a certain plant having quite a number of woodworking machines. He went out around the plant, looked the machines over, found that a great many of them, circular saws in particular, had no guards of any description. He got hold of a well illustrated catalog, picked out a nice line of guards, brought them into the plant and had them put on the machines.

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He expected that the woodworking accidents would come down, but they didn't.

GUARDS FOR BAND SAWS

On some machines, there is no question about what guards to provide and how to keep them in place. For example, the band saw. There are certain fundamental guards for all band saws; guards for upper and lower wheel, for the saw on the return side, and for the portion of the saw above the guide. In designing the guards for the wheels, sufficient space should be left around the periphery so that in case the saw breaks, it will not whip itself to pieces by being caught in between the wheel and the guard. I know of one case where a guard fitted very closely around the periphery of the upper wheel and a saw was practically torn to pieces. I hardly think there was a piece longer than a foot left when the machine was finally shut down.

The band re-saw wheels are guarded like the wheels on the smaller band saws. Two pieces of boiler plate are secured in place to guard the feed rolls in front of the saw. They have a slight spring action. They are about an inch and a half or two inches apart, which is not enough for a man to put his hand through. As the rolls widen out, the guards spring in a trifle until they allow just barely room for the stock to go in. If the man feeds the work in with his hand on top, as he should, his fingers on one side and his wrist against the other, his hand will come up against that guard before it gets anywhere near the rolls. Without that, he would very likely run his fingers into the rolls.

CIRCULAR SAW GUARDS

Circular saws should be treated like punch presses; do not try to use one guard for all operations. It is my opinion that for repetition work a guard should be made to handle that particular job. I believe that the point of operation on a circular saw should be out where the man can see it. I had about six months' work myself in a woodworking shop before I went to the General Electric Company, and from my experience when operating circular saws, I would much rather be able to see where the saw is entering the wood, than to know it is up in there somewhere without knowing I was within half an inch of where it is.

INDIVIDUAL DRIVE

All of our machines are individually driven and so arranged that a man can stop his machine without taking either hand off his work. A handle is connected to the switch in such a manner that to start the motor the handle has to be pulled off about three inches. To stop the motor, the operator merely hits that handle with his knee.

On a heavy rip saw with feed rolls we have a guard which covers the feed rolls and the splitter. This is entirely satisfactory, and I don't believe that any workman would object to having the guard on his machine.

On a machine used entirely for cutting round stock, either tubing or solid, we have a guard, designed and built by the man who runs the

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machine, which has increased the operator's production about twenty per cent.

The guard has an adjustable groove that he can set for various sizes of stock.

SWING SAW GUARDS

Swing saws are generally guarded over the saw and at the belt. In addition, it is desirable to install a latch so that when the frame swings back, it will stop and not rebound halfway across the table in case the overhead counterweights slip a trifle. The handle to release the latch is just over the machine handle, so it is operated without any additional motion or effort.

There is one thing, however, for which you cannot provide a guard, and that is having an inexperienced man try to operate a woodworking machine.

Another point that requires careful attention is preventing slipperiness of floors around machines. If you keep the surface rough you will have fewer accidents than on a smooth floor.

DISCUSSION

CHAIRMAN PAINE: I think that the German combination spreader and saw guard which has been in use for something like twenty years which just throws an arch over the saw so that it does not obstruct the work and still gives you a good view of every cut necessary on that piece of work, is a very useful guard. I do not know of an accident having occurred on a saw equipped with this guard.

MR. HUGH MORRISON (Patternmakers' League of North America, Cliftondale, Mass.): The hood that the chairman speaks of, I believe, is the most practical guard for a circular saw. I have seen it in operation and I never knew of any accident occurring on a saw where that guard was used.

CHAIRMAN PAINE: About four years ago, there was a plant that was called to my attention where there were very few guards, but a suprisingly low number of accidents. It was so remarkable that we made an investigation and learned that the plant was run by a Scotchman and his four sons. The owner never allowed an apprentice boy to operate a machine; neither did he allow anyone to do any machine operation unless he was thoroughly trained in that specific work. Unfortunately, such conditions are not found in the average woodworking plant, and guards are necessary to protect the men who are not skilled woodworkers.

Guards, however, are desirable even in plants where the men are all skilled workmen. Many workers become careless, and it has been definitely proved that most of us from time to time have temporary lapses of memory; and, although of short duration, these lapses greatly increase the danger of accidents.

MR. HAVILAND: I was greatly impressed with the statement made by Mr. Guilbert, who said that there was absolutely no excuse for accidents on machines in a woodworking plant, and to substantiate this he read statistics which showed that the percentage of machine accidents in their plant has been reduced to 10 per cent.

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In the first place, I believe that he understands machine guards. But more than that, I think the real reason is that they have a class of skilled men who understand woodworking machines and operations.

I would rather see a plant where every man in it was experienced and trained to do the work and not have any guards at all, than have all kinds of guards and have inexperienced men that are put on without any preliminary training and just told to go ahead.

THE NEW SAFETY CODE FOR WOODWORKING PLANTS

DR. LUCIAN W. CHANEY, UNITED STATES BUREAU OF LABOR STATISTICS, WASHINGTON, D. C.

The utility of these national codes is going to be settled by you people who are engaged in the safety game in the various industrial plants. It isn't the legislature, it isn't any national body; it is you people who are right in contact with the job who are going to decide whether it has been worth while to spend the time which has been spent upon these codes.

In all probability no state in the union will adopt any safety code complete simply because each code, so far as I know, goes beyond the point, and ought to go beyond the point, which any state is willing to put on its statute books as a definite requirement. The states that plan to base their codes upon the code on which we are now working will certainly modify our requirements and make them less rigid.

The progress of safety efforts in the industries has been determined by the industries themselves. I don't know of any plant of importance in this country which doesn't impose upon itself more rigid rules with regard to safeguarding and matters of that sort than the laws of the state in which it is located. Of course, you will find the official picking out here and there things which he thinks are not up to the state standard and calling attention to them, but by and large, the industrial plants do insist upon a more strenuous code for themselves than the state insists for them.

That brings it right back to you safety men to determine whether this woodworking code and the other codes which the national organization is now trying to formulate are worth the time that has been put upon them.

Mr. Riffel, Engineer for the National Workmen's Compensation Service Bureau, New York City, has had the laboring oar in bringing together the material which has been embodied in the present proposed code for the woodworking industry, and I think we all owe a good deal to the Compensation Service Bureau and Mr. Riffel for the work which they have donated to the task of bringing these codes, this and some others, into existence. So I am going to ask Mr. Riffel to state to you how this code has come into its present state.

MR. RIFFEL: The American Engineering Standards Committee, formed in December, 1916, is now composed of forty-seven members representing seventeen bodies, six national engineering societies, five governmental departments, and thirteen national industrial associations. The main

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committee does not concern itself with the technical details in preparing safety codes, but merely acts as an administrative body.

Any responsible organization has the privilege of suggesting the development of a standard code on any subject in which it is interested. The main committee passes upon the advisability of undertaking work on the subject suggested, and, if approved, this main committee appoints one or more responsible organizations as sponsors for the proposed work. To date, thirty-six subjects have been approved and sponsors appointed for the development of the standard codes.

In each case the sponsors appoint a sectional committee which, to be truly representative of the various interests involved, should include representatives from the manufacturers (makers of equipment), employers (purchasers, owners, and consumers of equipment), employees (users of equipment), governmental bodies (federal and state), technical associations (engineering societies), and insurance organizations.

The sectional committee does the actual work in developing a standard code. When completed, it is referred to the sponsors, and then to the main committee. If the code is approved, the main committee authorizes the sponsors to publish the code under an appropriate title such as "Recommended American Practices", "Tentative American Standards", or "American Standards."

The sponsors for the Woodworking Code are the International Association of Accident Boards and Commissions, and the National Workmen's Compensation Service Bureau.

The code was drafted, criticised, revised, and then submitted to two hundred manufacturers in the woodworking industry as well as to the members of the sectional committee.

Several points that are still under discussion are: The need for exhaust systems in small woodworking shops having less than five machines; the proper areas for exhaust pipes; and the advisability of using sheet metal heavier than No. 20 gauge or reinforcing No. 20 gauge metal where hoods serve as guards over cutter heads. Some man questions the necessity for having a clean-out in exhaust pipes every ten feet. Another advises the recommendation of a minimum width for aisles. Still another man states that it is neither practical nor necessary to provide individual controlling devices for each spindle on a shaper.

"POINT OF OPERATION"

Mr. Ralph E. Prouty (Safety Engineer, Aetna Life Insurance Company, Hartford, Conn.): The code as it now stands defines "point of operation" as follows: "Point of operation or feed refers to conditions under which the operator's hands might be cut or crushed while feeding or operating the machine, such as, in case of in-running rolls, rotating or reciprocating knives or cutters, or shearing or crushing action." I respectfully submit that this definition is unsatisfactory. The point of operation is not a condition—it is a part of a machine. I should like to suggest that this definition be changed to read somewhat as follows: "Point of operation means the part of the machine at which stock is inserted or held in contact with the forming, cutting, shaping or other mechanism."

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SELF-FEEDING DEVICES

Rule 201 reads as follows: "It is recommended that automatic self-feeding devices on machines be used wherever the nature of the work will permit." This rule may be interpreted to mean that self-feeding devices which are already installed should be *used* wherever the nature of the work will permit, or that self-feeding devices should be *installed* on machines wherever the nature of the work permits. I assume the latter interpretation to be the correct one, and should suggest the substitution of "be installed" for "be used."

In the same manner, Rules 502 and 503 can, undoubtedly, be improved by rewording them. Rule 502 reads: "Each bolt, stave and heading equalizer shall have the saws encased to prevent accidental contact except that portion immediately adjacent to the feeding device." Is accidental contact with the portion adjacent to the feeding device desirable? One might so infer from the wording of this rule. Would it not be better to have the rule read: "To guard against accidental contact, the saws of each bolt, stave and heading equalizer shall be completely enclosed except

HOODS FOR RIP SAWS

Rule 300, Section (a) reads: "Each circular rip saw shall be guarded by a hood which shall cover the saw at all times at least to the depth of the teeth. The guard shall adjust itself automatically to the thickness of, and shall remain in contact with, the material being cut. The hood shall be so designed as to protect the operator from kick backs, flying splinters and broken saw teeth." I invite your attention to the absence of specifications for the construction of hoods and ask, Will this rule accomplish the desired result? I am inclined to believe that it will not unless it is revised to include specifications for materials acceptable for hood constructions and also definite rules relative to installation. Unless some such change is made, flimsy sheet metal and wooden hoods insecurely fastened to the machines will be continued in use.

Section 30 of the Code is headed "Circular Rip, Resaws, and Swing Cut-Off Saws." A careful study fails to reveal any standards whatever for circular cross-cut saws. This omission might lead to an attempt to apply the standards for guarding rip saws to cross-cut saws and as the hazards arising from the operation of the latter are different than those from the former, it is very doubtful if practical woodworkers would agree to such application. For instance, a spreader would hardly be required for cross-cut saws. I should like to suggest that the Committee study the advisability of including a definite standard for guarding cross-cut saws in Section 30 of the Code.

Rule 308—Guarding of Saw Beneath and Behind Table. "The exhaust hood, or other guard, if no exhaust system is required, shall be so arranged and maintained as to guard effectively that portion of the saw which is beneath and behind the saw table." Under this rule each enforcing body or official will be permitted to decide what constitutes an effective guard. If this code is to serve the purpose for which it is being the portion immediately adjacent to the feeding device."

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devised, namely, to provide universal standards, Rule 308 should define an acceptable guard. Otherwise, we shall have practically the same condition which exists at the present time, when state inspectors, insurance inspectors, and plant safety engineers are all making recommendations which are not identical and which usually result in confusing the plant official who passes on their practicability and causes him to reject all of them. I should like to suggest the substitution of a rule along the lines of the following to take the place of Rule 308: "The portion of the saw beneath and behind the saw table should be so guarded by the exhaust hood or a special guard that it is impossible for any one to come in contact with the saw blade by reaching over, under, around, or through the hood or guard."

All of you who had the pleasure of listening to Mr. Schreiber's talk at the Ninth Annual Safety Congress at Milwaukee, or who have read it since, must have been impressed with the extreme importance of the proper inspection, filing and setting of circular saws as safety measures. These points are covered to a certain extent by the Rules under Section 80 of the Code. I wonder if the force of these rules would not be greater if they were subdivided and appended to the sections dealing with special types of woodworking machinery.

Mr. Keown: I think one reason for many saw accidents is that the saws are not properly maintained. I also believe that in many cases the guards should entirely cover the saw and be self-adjusting.

Many people object to the use of guards when ripping narrow material where the guard interferes with the gauge, and I have often wondered why the gauge on circular saw tables is made as high as it generally is. I suppose that 95 per cent of the work is very much thinner than the height of the gauge, yet the gauge is made for the occasional cutting of the piece edgewise. I have seen a narrow maple or other hardwood strip, straight edge, placed on a saw table. This is fastened to the gauge and put between the gauge and the work that is being cut, so as to permit you to keep the gauge back away from the saw; it doesn't interfere with the guard coming down over the work.

Mr. C. Fred Wolf (Travelers Insurance Company, Hartford, Conn.): I saw an accident happen where in pushing a board through a saw for straightening off the edge, the board raised up and swung across the saw and cut a circle in the bottom of the board. I think the National Safety Council had a bulletin depicting such an accident a few months ago. I have often wondered if it wouldn't be a good thing on a saw to have some form of protection in the form of a stout piece of pipe that could be telescopic and rigidly fastened at the side of the saw, so if you shove a board under it, it couldn't raise up.

Mr. Riffel: I would like to reply to Mr. Prouty's remarks. We had to be careful not to be too specific on this question of guards. There are so many saw guards on the market that any specifications of the best guard, if there is such a thing, would exclude all the others. And furthermore, we felt that we were rather specific when we stated that the guard should project beyond the teeth of the saw. Sizes of materials used in guard construction are also given. If I were in a plant, I should

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much rather know what size of material I can use in building my guard, and then build a guard suitable for a particular saw or work which is to be performed.

MR. PROUTY: My impression was that the standards contained nothing which would show the gauge of sheet metal, for instance, to be used in the construction of a hood.

MR. RIFFEL: You will find in the code a table which gives No. 20 as the smallest gauge of sheet metal that you can use. By the way, that will appear in the Power Transmission Code. It gives you sizes for expanded metal, perforated metal, and all the rest.

MR. PROUTY: Does that apply to hoods or simply to belt guards?

MR. RIFFEL: There are no belt guards considered in this code at all; they are considered in the Power Transmission code. The size of material specified in the Woodworking Code for guards for the point of operation are the same as the specifications for belt guards given in the Power Transmission Code. One of the questions that came up, was the desirability of re-enforcing No. 20 gauge sheet metal with heavier material where it is used over planer knives, jointers, and so on, in order to prevent the knives, if they should come out, from cutting through the material.

MR. W. B. KINGHORN (Travelers Insurance Company, Boston, Mass.): I believe that the design of saw guards is really a problem to be solved by the individual superintendent or plant foreman. One of the best saw guards I have ever seen was made in the Cambridge plant of the Standard Oil Company. It was fastened permanently to the machine. Instead of being operated or lifted by the work, it is lifted by the front gauge on the machine that slides the work back and forth.

It might be interesting to know that we classified 1,300 or 1,400 accidents that occurred in woodworking plants and found that over 10 per cent of them were caused on the jointer. Therefore, we consider it just as important to guard the jointer as it is any other machine in the woodworking industry.

DR. CHANEY: The proposed code provides that the cylinder head shall be recommended—I don't remember whether it goes stronger than that—and that the part of the head which is not in use shall be covered.

MR. KEOWN: Rule 320 provides that each hand-feed planer and jointer with horizontal head shall have an adjustable or automatic guard. What is meant by adjustable? Does that mean a guard that can be fastened to admit a certain width of material and then does not change its position after the material has passed through?

MR. RIFFEL: There is one guard that I have in mind that is adjustable, inasmuch as it can be slid back for specialized operations. Personally, I am in favor of a springing guard that adjusts itself, but here again is a case where we didn't want to rule out any particular type of guard.

MR. HAVILAND: I notice that the code does not refer to square head jointers at all. Indiana has a law prohibiting square head jointers, and I imagine some of the other states have too.

MR. CHESWORTH: In some plants where they cut small moulding, you can't use a round cylinder. That is the case here in some small factories.

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You can't make round heads absolutely mandatory; you must give them a little leeway.

MR. HAVILAND: May I ask Mr. Keown, aren't square head jointers prohibited in Wisconsin?

MR. KEOWN: On hand jointers, yes.

MR. KINGHORN: I would like to hear some discussion about guarding a mortising machine.

MR. RIFFEL: We had a special committee appointed to investigate the guarding of mortising machines. The machine, as I understand it, has a traveling chisel that goes up very fast and makes a quarter turn at every stroke. We went to one of the ship-building plants in New York and to other woodworking plants. Wherever they had one of those machines, it was out of use. We saw one type of mortiser with the square chisel and another type with the hollow chisel and the bit inside. Then Mr. Hall, the superintendent of our inspection division, sent letters to his various inspectors. We got back about three answers, and each reply indicated that the machines are becoming obsolete. Consequently, we couldn't get any definite information.

MR. CHESWORTH: I don't think I have seen a plunger mortiser for the last eight years. Everything has drifted now to the hollow chisel.

CHAIRMAN PAINE: One employer is trying out a telescopic guard through which you can see. It works up and down with the mortising chisel and keeps the operator's hand from coming in contact with the mortiser.

DR. CHANEY: You will recall that Mr. Riffel read a criticism of one provision of our code which required individual starting and stopping in the case of a double-head shaper. This critic thought it was impracticable to make any such requirement, but it has been made in some cases. Have any of you had any experience with reference to the individual control of the shaper head?

MR. SANFORD: It has been the practice in the General Electric plants for quite a number of years to have individual motors on each shaper head.

DR. CHANEY: Do you remember, Mr. Riffel, in what respect your critic thought that was impracticable?

MR. RIFFEL: No; he simply said it was impracticable.

DR. CHANEY: Someone criticised the requirement that the unused portion of a sanding belt be covered. Is there any reason why it shouldn't be done?

CHAIRMAN PAINE: We had photographs taken of well-guarded sanding belts which we included in the Service Bureau handbook of woodworking safeguards. I think two hundred woodworking plants reviewed that book and not a comment was made on the guarded sand belt.

MR. RIFFEL: Some persons consider it unnecessary to install clean-outs in exhaust pipes every ten feet.

MR. SANFORD: I know several cases where it was absolutely impossible to install clean-outs ten feet apart. I would suggest that the rule be so worded that enough clean-outs will be installed to give access to the entire line of pipe.

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DR. CHANEY: We run up against this difficulty—if we say every ten feet, that is too specific, and if we say sufficiently numerous to clean out the whole pipe, that isn't specific enough. The committee constantly has difficulties of this sort, either we say too much or too little, and I suppose that ultimately we will have to flip a coin to decide which we will do.

CHAIRMAN PAINE: May we at this time have the report from the nominating committee?

MR. KEOWN: For chairman of the section, we nominate Mr. Harry Guilbert, of the Haskell and Barker Car Company.

For vice-chairman, we nominate Mr. W. S. Paine, Research Engineer for the Aetna Life Insurance Company.

For Secretary, we nominate Mr. H. P. Barham, Treasurer of the A. C. Stearns Lumber Company, Boston.

(Upon motion of Mr. Haviland, duly seconded, the report of the nominating committee was accepted, and a unanimous vote was cast for the gentlemen named.)

CHAIRMAN PAINE: I will speak for Mr. Guilbert, Mr. Barham, and myself in saying that we will co-operate in every way possible to make this section a success; we can do this, however, only when we have the co-operation of every man in the section.

FRIDAY MORNING SESSION

THE meeting was called to order by Mr. W. S. Paine. In the absence of Mr. Orris, Chairman Paine read his paper on "Guarding Woodworking Machines, from the Viewpoint of the Operator."

GUARDING WOODWORKING MACHINES FROM THE VIEWPOINT OF THE OPERATOR

GEORGE ORRIS, ORGANIZER, UNITED BROTHERHOOD OF CARPENTERS AND JOINERS, INDIANAPOLIS, IND.

I am deeply interested in work that requires the use of woodworking machines. For the last twenty-eight years I have specialized in this line. In my early days, most of the woodworking machines were not guarded at all; in later years we find that many guards and safety appliances are used with excellent results to the operator who has to make his living on these machines.

My first experience was with a concern in Davenport, Iowa. I saw men injured nearly every day at this place; in fact we called this place "the butcher shop". I saw a man's throat cut with a knife that flew from the head of a moulding machine that was fully fifty feet away. I saw ever so many have their fingers and even their hands and arms cut off on saws, jointers, and shapers that were unguarded. One of my fellow workmen had his jacket sleeve caught in some gears and had his arm crushed and mangled, and later died from the results.

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NO COMPENSATION IN OLD DAYS

In those days there was little or no insurance, and when one was injured he had to suffer the consequence of his bad luck all alone. Many a wife has been compelled to take in washing because of the total disability of the husband who worked in a woodworking shop upon unguarded machinery.

Later on I moved to Chicago, following my trade, and it was there that I became acquainted with the whole subject of safety. I joined an organization of woodworkers and later on became their president. I had over ten thousand members to look after, and my time was taken up in visiting the injured and sick members that had been hurt in the performance of their duties. As time rolled on, we began to have more guarded machinery and I remember well that some employers as well as some operators claimed that guarding machinery was a handicap to the operator. The more sensible employer and employee agreed that it was the proper thing and made way for more efficiency.

And let me add right here, that the employer who has a well-lighted shop with clean floors, and machinery that is safeguarded can produce more and better work than the employer who has the opposite kind of a place.

WHOLE UNION MEMBERSHIP VICTIMS OF ACCIDENTS

We have one local union in New York City, composed of machine hands and it might be amusing to you if you could sit in one of their meetings and see them conduct their business. The president says when he puts a motion before the house, "All who are in favor of the motion make it known by holding up your stumps". There is hardly a man in that local who has not received an injury. The organization of which I am still a member, pays out thousands and thousands of dollars to our members who have become totally disabled.

Most of these injuries and accidents which are as costly to the employer and employee can be eliminated, and from a humanitarian standpoint our government should see that a law is made to cover the safeguarding of woodworking machinery. There are about five hundred thousand men and women working at this branch of industry, and when I state that there are thousands and thousands of them injured every year on account of unguarded machinery, slippery floors, insufficient light for the operator, open stairways, and many other things that could be eliminated, as well as the carelessness of the employees, I am putting it in a very light form.

In conclusion I will say again that I am deeply interested in the work of your organization. My organization, the United Brotherhood of Carpenters and Joiners of America, will be more than pleased to co-operate with you or the employers and manufacturers of woodworking machinery in bringing about a universal law that will eliminate misery and suffering in the homes of the operator and bring about better and more efficient work for the employer. I look upon it as being a great work from a humanitarian standpoint and I wish you speedy success in this great undertaking.

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FIRE HAZARDS IN WOODWORKING PLANTS

H. E. Newell, Engineer, Committee on Fire Prevention and Engineering Standards, National Board of Fire Underwriters, New York City

Lumber yard fires are among the worst that a fire department has to combat. Yards are frequently found close to thickly built shingle-roof frame dwelling districts, hence the officer fighting such a fire must use considerable discretion in using heavy stream appliances, owing to the attendant spark and flying brand hazard. Where such fires gain considerable headway, it often happens that the fire is permitted to burn itself out and the efforts of the fire department are confined to preventing its spread to nearby factories or dwellings. Fire causes include sparks from locomotives, smoking, and exposure to fires; many are due to the latter cause as lumber yards are usually found in connection with woodworking establishments and consequently are subject to all of their inherent hazards. All yards should, if possible, be so located as to be within the radius of response of a municipal fire department; this protection should be supplemented by private protection including the following:

LUMBER YARD FIRE SAFEGUARDS

A yard system of at least 6-inch water mains so gated that no single break will materially impair its value; hydrants equipped with at least two 2½-inch outlets and if engines must be used, 1 steamer outlet, spaced not less than 200 feet apart. At each, or every other hydrant, depending upon the size of the yard, there should be a standard hose house, painted red and provided with not less than 200 feet of 2⅝ inch single jacketed, cotton, rubber lined fire hose bearing the underwriters' label and equipped with 2½-inch National Standard hose couplings; a play pipe with ⅞ inch tip, hydrant wrench, spanner and supply of rubber gaskets.

Also there should be: a city fire alarm box at the entrance to the yard, and attached thereto auxiliary boxes of approved type at proper locations within the yard; a private fire brigade composed of yard employees, properly drilled and instructed as to procedure and use of private appliances; and water barrels and pails, painted red, conspicuously labeled and liberally distributed among the lumber piles.

The height of piles should be limited to 20 feet and the spaces between piles regulated by local conditions, but of width sufficient for fire department operations. The main driveway should be arranged if possible to divide the yard in half and form at least a partial fire break and vantage point for the fire department; in very large yards there should be several open spaces at least 200 feet in width. In brief, lumber should be arranged in units designed to impede the spread of fire from pile to pile.

Frame construction and shingle roofs within the yard increase the general hazard and should be condemned. Smoking should be prohibited and "no smoking" signs posted in prominent places.

Fire hydrants and hose houses should be kept clear of all material, and the employee in charge of the fire brigade required to make daily inspections to insure such conditions.

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Monitor nozzles have been employed in some yards, with good effect; their general efficiency however, is a much mooted question. Their advantages over fire hydrants may be summed up as follows: only one man is required to place a monitor nozzle in service; they can be placed in service much quicker than an ordinary hose stream; can be abandoned and arranged so as to still discharge water in the direction of a fire; they furnish a more effective stream for same sized orifice due to larger supply pipe. Their disadvantages are: being in a fixed position, they cannot reach a fire near the base of the middle, or the far side of a pile; greater cost than hydrant and hose equipment, which should be materially increased if nozzles require close spacing to be effective. They are undoubtedly of value and probably can be used to best advantage in combination with fire hydrants. It is the practice to place them on heavy timber towers; the danger of these towers burning and breaking off risers to monitors should be given consideration as the flow through such broken connections would very likely seriously impair the efficiency of the distribution system.

The necessity of keeping yards free of scrap material and rubbish is imperative. Yard and switch engines should be provided with spark arresters, and the dumping of ash pans within yard limits prohibited.

WOOD WORKERS

The term "woodworkers" may be defined as applying to the following industries: saw mills, planing mills, sash, door, and blind factories, hard wood turning, box factories, lead pencil, cooperage, carriage and wagon factories, shingle mills, furniture, cabinet and piano factories, and establishments for the manufacture of spools and various kinds of wooden ware.

Hazards common to all of the industries named may be grouped as follows:

Common Hazards	*Special Hazards*
Lighting	Shaving and dust vault
Heating	Dry kilns
Power	Refuse burner
Boiler-feed	Spontaneous ignition
Rubbish	Blower system
Oily material	Sawing
Smoking	Dust

COMMON HAZARDS

LIGHTING. Electricity or gas is usually employed for this purpose; oil lighting is so rare as to be practically negligible. Where oil is used, the hazard formed is pronounced and mainly due to liability of breaking or overturning, although there is also considerable danger of explosion due to loose wicks, poor oil, and carelessness. This form of lighting should be emphatically condemned.

Gas is mainly objectionable because of jets being located in the vicinity of combustible material and flying dust.

Lighting should be by electricity; all moters, switches, starting or other

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devices likely to produce arcs should be of the totally enclosed type as required by the National Electrical Code.

HEATING. This is usually by steam or hot air. Stoves in buildings of such occupancies are especially reprehensible because they form a hazard that cannot be adequately safeguarded and of which the occupant must be aware.

Direct heating by steam is safe and preferable, provided combustible materials are kept from contact with steam pipes or radiators. It is a good plan to require that radiators or coils be screened or protected by incombustible covers installed at such an angle as to prevent the depositing or storing of materials thereon, and prevent the lumber or other material coming nearer than 6 inches to the pipes or coils; a space of 6 inches should be left under screens or guards and pipes to premit sweeping out. Pipes passing through partitions or floors should be properly collared.

Heating by hot air is objectionable because pipes must necessarily be run through floors and walls; under fire conditions sections of piping are likely to fall, thus forming flues facilitating the passage of flame from floor to floor or room to room; furthermore it is extremely difficult to so install dampers so as to form effective automatic fire stops.

POWER. The form most prevalent is steam with belt and shaft transmission. The engine is usually located in the most convenient place on the first floor or in the basement. Electricity, water, and gas engines are also used for this purpose; their hazard is not material if properly safeguarded. Gas engines present the most severe hazard, especially if flame ignition is used and also due to the use of gasolene or other flammable liquid for starting; however, if of the electric ignition type and properly installed, the hazard does not exceed that of the steam engine.

Shafting lines and pulleys form a hazard common to all. This hazard is solely one of heating effect incident to excessive friction; it may be minimized, but it cannot be eliminated as hot bearings are always possibilities. The sources of excessive friction attendant to shafting and belts for power transmission include, journals and bearings out of alignment; improper fittings or materials; poor lubrication; loose bushings in wood pulleys; pulleys overloaded or out of balance; belts frayed or in contact with woodwork and belts slipping on wood rims.

The so-called "wood split pulley" is the usual wooden type; its chief defect is likelihood of looseness at the bushing. While overheating from some of the foregoing causes is at times unavoidable, direct responsibility for fires is in most cases due to faulty arrangements or to conditions. Illustrative instances are: machines belted to a small auxiliary or counter shaft located on the floor—these being mainly boxed in, form receptacles for the collection of oily sawdust; lines of shafting run in trenches or low basements, not readily accessible for lubrication and cleaning; and wooden pulleys also collecting dust, which is rarely cleaned out. These and numerous others of less frequency are dangerous conditions leading to fires.

Next in importance is the location and care of the engine room; it is very frequently located where sawdust can collect underneath or around

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the foundations. The engine or dynamo should be located in a properly cut off addition, preferably one-story and of fire resisting construction, by "properly cut off" is meant, at least a 12-inch brick or a concrete wall, with openings protected on both sides by standard fire doors; such a wall, however, should preferably be blank.

ELECTRIC POWER BEST

The best form of power is electric with woodworking machines operated by shafting and motors located in a fire resistive basement. This, of course, necessitates belt openings in the floor, but in a one-story building this is not serious. If the building exceeds two stories, individual motors for machines should be provided in order to eliminate floor openings incident to belts and shafting.

BOILERS AND FUEL. The boiler plant is usually a one-story wing to the main building often lacking a proper cut off; light ordinary construction is the rule. Fuel is generally shavings and other mill refuse, supplemented by coal. Shavings may be fed to furnace by hand, or may be drawn into furnace through metal pipes direct from cyclone; the latter method is safer.

FAULTY CONSTRUCTION OR ARRANGEMENT CHIEF FIRE CAUSE

The numerous fires originating in the boiler room are partly due to the inherent hazard of burning light materials, however well safeguarded, but mainly to faulty construction and arrangement.

The fire causes most prevalent are "back draughts" or in other words smoke vapor and gas explosions inside the furnace, which throw sparks or coal from the furnace into shavings piles and vaults. A poorly arranged furnace feed pipe may cause fire to be carried back through this pipe into the shavings vault, or into the main plant. Back draughts can also be caused by certain types of cyclones and by top center piece of the cyclone falling or being removed while fan is running. Other causes of fire are failure to disconnect furnace feeders or close dampers in same after fan shuts down; accumulation of dust on roof of boiler house from cyclone; boiler stacks unsafe due to poor location, arrangement, or insufficient height; dust and refuse on tops of boilers; faulty boiler setting; lack of proper shavings vault; ceiling of boiler room not properly protected where in proximity to smoke box or flue, or to the shell or dome of boiler; smoke box or flue in poor repair, permitting escape of sparks; sparks getting into fan blower of heating system; and weak construction of boiler room.

The boiler room should be constructed of fire resistive materials and properly cut off from all portions of the main or other buildings. The stack should be of brick, located outside with a brick flue from boilers; and the top of stack should be at least 35 feet above top of boiler house. Coal, if used, should be stored outside in a detached shed. Shavings vault and furnace feed should be properly arranged.

RUBBISH. Rubbish fires are mainly due to spontaneous ignition resulting from lack of proper cleanliness; piles of rubbish and sweepings not

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properly removed and left overnight in combustible receptables; accumulation of dust around steam pipes, under benches, inside belt boxes, and around pulleys and shafting. Such material should be removed promptly and not permitted to accumulate; this can best be accomplished by means of a properly installed blower system.

OILY MATERIALS. Closets or lockers should be of incombustible material. Waste, when not in use, should be kept in metal receptacles. Oily materials are discussed under the head of spontaneous ignition.

EXPOSURE. The features upon which the degree of exponsure depends may be arranged as follows: construction, protection to horizontal and vertical openings and individual separation of buildings. Frame construction is the type often employed at such plants; and buildings, for convenience of operation are closely grouped, thus forming severe mutual exposures. Under such conditions, protection to horizontal and vertical openings and even the presence of automatic sprinklers offers little resistance to exposure fires, owing to the great heat conducting properties of wood. This is by no means an argument against the desirability of the protection named, but against the use of frame construction in the woodworking industry. It is pointed out that automatic sprinklers supplemented by protection to horizontal and vertical openings is efficient to a pronounced degree in extinguishing fires in their incipiency, and preventing fires originating in such frame buildings from spreading and involving the entire plant. Hence the need of such protection in frame buildings is imperative for the reasons named and to prevent the development of exposures in any plant or building. Buildings of joisted brick construction should be protected against exposures by the methods described. Mill construction if properly sprinklered and supplemented by adequate window and vertical opening protection is a very good form of construction for these industries. The ideal form of construction is, of course, fireproof, but the former is satisfactory.

SMOKING SHOULD BE PROHIBITED IN PLANT

Many fires in these industries have been caused by employees smoking. Where occupancies are of such a highly combustible nature, it goes without saying that no smoking should be permitted. "No Smoking" signs should be conspicuously posted about the plant and the penalty of instant dismissal applied to all violations of this rule.

SPECIAL HAZARDS

BLOWER SYSTEMS. Blower systems, if properly installed practically eliminate the dust and refuse hazard in such establishments. Conditions are possible, however, under which heated bearings may cause fires, and faulty installation permit the passage or generation of sparks either in the exhausts or other parts of the piping, hence the National Board rules for the installation of blower systems should be strictly adhered to.

The cyclone or separators should be outside the building and so located as not to constitute a hazard to adjacent structures. Their construction and supports should be of incombustible material. If the cyclone is necessarily within ten feet of wooden walls, flammable structures, or openings

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into buildings, it should be provided with a metal pipe, extending to a point above the main roof or other safe location. The refuse from cyclone should be discharged by gravity into a vault as follows:

If the discharge from cyclone conveys the refuse directly to the fire box of boilers, the feed spout should have an open end discharging into a suitable receiver near the furnace, so that when the furnace becomes choked, the refuse will fall out on the boiler room floor thus giving the fireman a warning; it will also prevent "back fire" when the fan blowing the refuse is stopped. The vent from the cyclone collector should be properly screened and must not be connected to a chimney.

SHAVINGS VAULTS. These are necessary in all woodworking establishments involving any considerable quantity of shavings and dust; not only as a means of disposal of such material but also for its storage for fuel purposes. The hazard is mainly that of dust explosion; numerous fires have been caused by sparks from boiler fire box being blown into the vault and occasionally by sparks being sucked in through the cyclone. Oily dust and wiping waste form additional hazards and should not be swept into exhausts.

SPECIFICATIONS FOR SHAVINGS VAULTS

Vaults for shavings, sawdust, etc., should be located outside of building. Walls, floor, and roof should be of brick or other approved fire resisting materials. If located inside, safety vents to outside air should be provided; these are to relieve the force of an explosion. Openings, if any, between vault and boiler room should not exceed 9 square feet, and bottom of opening be not less than 6 inches above the level of boiler room floor. Openings to be located at least 8 feet from the firing door of boiler, preferably at right angles, and protected by a standard automatic fire door. Roof of vault should be provided with proper ventilating opening not less than 6 inches in diameter. As a protection from the weather a suitable metal ventilator may be necessary.

Vaults should be protected by approved automatic sprinklers. Where such protection is not available, steam jets should be installed for fire extinguishing purposes. No wall of the vault should form a part of the boiler setting, owing to the cracks which are apt to form in the latter; if the structure adjoins the boiler or engine rooms, its walls toward them should be carried through the roof and parapeted.

LUMBER KILNS. In general, kilns may be classified as direct-heated and steam-heated. Direct-heated kilns may be further sub-divided into what are known as furnace, smoke, and open-fire kilns.

TYPES OF KILNS

Furnace kilns are those in which stoves or furnace-like fireplaces are utilized to supply the heat, the furnace or stove jutting into the kiln-room or being built in a pit inside the kiln structure. In this type, metal smoke flues may or may not be zig-zagged back and forth or coiled in the kiln-house before venting to the outside air. Obviously, this type of kiln is very hazardous, owing to the possibility of live sparks or heated jets of air escaping from cracks or crevices in the top plate or sides of the

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furnace or stove, or in the smoke flues from them, not to mention the direct exposure of the stock to be dried or portions of the structure near the stoves, furnaces, or flues, through accident or poor arrangement.

The open-fire and smoke processes are crude methods in which the stock to be dried is piled or stacked around and over an open fire built in a pit in the ground, the stack being enclosed by common boards laid against it and standing on end or built as a sort of fence. The dangers of this method of drying are obvious, the flames, sparks, and smoke passing freely through the piled lumber and providing ripe conditions for the destruction of the edifice, if so flimsy an affair may be dignified with the term. This type of drier has fallen into disuse largely, being found at present mainly in southern states.

Steam-heated kilns may be subdivided into what is known as natural draft and blower systems. Natural draft kilns are the familiar ones encountered in all parts of the country, wherein live or exhaust steam-pipes are supported from above, arranged in coils about the sides of the room, sometimes placed vertically in the center, or, most frequently, built as a gridiron under the stock. Practically the only hazard of this type is what is known as the steam-pipe hazard, although what appears to be merely a theory has been advanced, that the banking up of hot air and the subsequent admission of cold air into such kilns could produce a fire. The steam-pipe hazard, however, is quite apt to be in its element in such kilns, especially where they are frame, inasmuch as the interior becomes in time desiccated, and splinters, short lengths of wood, dust, and pitch from the dried stock may accumulate upon the pipes.

THE BLOWER SYSTEM

In the blower type of kilns, the steam-pipes supplying the heat are located generally in large iron boxes, open at one end for the admission of air, which is drawn from the coils and blown on to the kiln-room by means of fans. The blower and coils used are the familiar hot-air heating apparatus, found so often in use in connection with the heating of churches, halls, schools, and factory buildings, the hot air in such cases being delivered to the desired points through metal flues. In addition to the steam-pipe hazard, the blowers or fans in this system of drying have the usual engine or electric motor hazard accompanying them, as well as bearing hazards of their own. The forced draft itself is not negligible as a hazard when a fire has once started, and, in addition, hot-air drafts have a peculiar charring effect upon wood, causing it to ignite at an alarmingly low temperature. It is even stated that warm-air drafts, especially in the form of jets such as might issue from the crevices in poor joints, will ignite wood at ordinary atmospheric temperatures. The explanation of this phenomenon is not at hand, notwithstanding the fact that it seems to have occurred frequently. It is just as well, however, to bear the possibility of fire occurring from this source in mind in the arrangement of kilns. The steam-coils and blowers for kilns are sometimes located in the engine or boiler-house, but are most frequently found in a small addition to the main kiln structure. In many instances the fan-room is crowded, dirty, and oily,

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so that fires starting at the bearings have a good chance to spread and are immediately conveyed to the interior of the kiln. It often happens that the iron box enclosing the steam-coils rests upon wooden supports. This practice should be discouraged, since the iron enclosure is at practically the same temperature as the coils themselves, and might cause trouble in time. To minimize the danger from the forced drafts in case of fire, it is possible to arrange flap-check valves in the main conduit to the kiln, so that one will fall into place across the conduit, shutting off the draft from the kiln, while at the same time another opens at a point outside the kiln to relieve the banked-up pressure ensuing. One objection to the blower system, which can be overcome effectually only by care as to the arrangement of the apparatus, is the fact that an induced draft is set up and may draw in upon the coils not only foreign flammable materials, but transient sparks from locomotives, boiler stacks, boiler furnaces, or exposure fires while the fan is in operation.

While it would seem that the blower system is much safer than any other in connection with the drying of lumber, it appears that such is not the case, and that natural draft kilns have greater immunity from fires than any other kind. The longevity of any kind of frame kiln, however, seems to be limited to five or six years, on the average, and this fact should not be lost sight of in considering dry-kilns as internal or external exposures.

DRY-KILNS SHOULD BE INCOMBUSTIBLE

There seems to be no valid reason why dry-kilns should not be made entirely incombustible, except, of course, as far as the contents are concerned, so that wisdom would dictate that any lumber dry-kiln, whether of the natural-draft or blower system, when inside or exposing a main building, should be absolutely fireproof as regards the material of its own construction. Automatic sprinklers in kilns are desirable, but owing to the manner in which lumber is piled in kilns these cannot operate to the best advantage. Steam-jets, however, in view of the confined nature of the space to be protected, should be valuable in the extinguishment of kiln fires.

REFUSE BURNERS. In connection with sawmills, refuse is burned in pits, piles, or furnaces especially built for the purpose. The pits or piles should evidently be located at a safe distance from the mill and lumber yards, as the wind carries the sparks and small brands surprisingly far. Two hundred feet clearance is frequently required, but this distance is by no means a guaranty of safety, especially if refuse is burned in huge piles, to which it is sent on conveyors or by hand. Such piles are sometimes seen burning continuously at the end of a long conveyor, which drops the refuse on the heap from a height of thirty to forty feet. It is hardly necessary to mention that these piles are a serious menace to surrounding property.

A regular slab burner is often found quite near the mill, sometimes within fifteen or twenty feet. It consists of a cylindrical furnace of brick or iron, lined with brick, with a dome-shaped wire screen spark-arrester at the top. They run about 10 to 20 feet in diameter and 30 to 60 feet in height. An opening in the side about 20 feet from the ground admits

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the refuse which is brought to the burner by a drag-conveyor. These are much safer than pit or pile burners, but may start fires. It is possible for a coal of fire or a brand to be carried back into the mill on the return portion of the conveyor. The spark-arresters become worn, allowing sparks to escape, and sparks sometimes issue from the lower doors or cracks above them.

In connection with broom factories, small brick furnaces are used to burn unavailable refuse. They are frequently too close to buildings and surrounded by straw.

SPONTANEOUS IGNITION. This hazard is linked with that of oily materials as described under common hazards. It is largely due to oily saw dust, the friction of saws and bearings being sufficient to set up enough heat to ignite the dust. The safeguarding of this hazard is largely a matter of "shop practice;" employees should be acquainted with the danger involved and be required to keep machinery clean and prevent accumulation of oily sawdust beneath machines; drip pans placed beneath lubricated parts will serve as an aid toward this end. Operators can readily clean off sawdust adhering to machines, with cotton waste; metallic self-closing oily waste cans should be provided at each machine for the safe storage of this wiping waste.

SAWING. Saws are of three types, namely, reciprocating, circular, and band. Machines known as surfacers, planers, and matchers are used to produce plane surfaces; there are also various other machines designed for several functions such as lathes, joint makers, tenoners, mortisers, dovetailers, etc.; various boring machines and sanders are also used. The added hazard of machines is the likelihood of a spark from the machine igniting the extra fine dust which the machine makes. Such a spark can be caused by undue friction, a nail in the stock, or some other similar cause. It is a hazard that cannot be eliminated. The use of automatic or machine grinders for saws and knives creates another hazard; these have grinding wheels or rotary files and many of them are run at a high rate of speed. This hazard also exists in hand grinding; it is mainly due to the fine and highly heated particles of steel when allowed to collect on an oily floor or mix with oily sawdust.

DUST HAZARD. Briefly this is due to the rapid ignition of dust particles suspended in the air, the ignition being so rapid as to amount to an explosion. The dust of any substances which will burn or oxidize will explode when properly mixed with air. As previously noted, dust also clogs bearings, causing them to heat, and many dusts, settling and becoming oily may ignite spontaneously.

DISCUSSION

MR. A. L. JILES: Mr. Newell suggests covering radiators completely in the steam system. Is that just to prevent the accumulation of dust or is it because the heat might otherwise start a fire?

MR. NEWELL: That is a screen to prevent using the radiator as a shelf, and also to keep combustible material from coming in contact with it.

MR. JILES: As I understand it, the temperature of a heating system runs about 212 degrees Fahrenheit, or a little higher. I was wondering

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if that was about the kindling point of any material that you would find in a woodworking plant?

MR. NEWELL: Take dust for instance; I think you would absolutely have to produce a spark before you could ignite it. The temperature of the radiator would in time char woodwork, and after it had once been charred, subsequent application of heat might result in ignition. You could not say, however, that would happen in every case—it might or it might not.

MR. J. A. DICKINSON (U. S. Bureau of Standards, Washington): You mentioned the possibility of sparks being carried from the refuse burner back into the mill by the conveyor. In one of the southern pine mills, I saw an installation in which the return side of the conveyor ran through a trough of water. I presume that this device was intended to prevent the conveyor from carrying sparks back into the mill.

MR. NEWELL: I imagine that is why it was provided.

MR. J. I. BANASH (Consulting Engineer, Chicago): Mr. Newell stated that a blower system is effective in keeping a place free from dust. In another part of the paper, he asks for completely enclosed electrical work. I happen to be on several committees which discuss various gas hazards; we know how difficult it is to get completely enclosed motors on account of the expense and the necessarily lower rating. Wouldn't ordinary motors be satisfactory in many cases?

CHAIRMAN PAINE: In framing the transmission code we made no provision for the complete enclosure of motors.

MR. BANASH: Don't think I am objecting to enclosed motors—they are mighty fine if you can get them.

CHAIRMAN PAINE: In one large plant there have been about eight cases of dermatitis from coca-bola wood dust about woodworking machines. They have an exhaust system installed, but evidently it is not working properly, for the men have to cart the refuse from the machines to the boiler room. Many exhaust systems fail because they were not properly designed, others fail because they are not properly maintained. I know of one case where the exhaust system was so strong that they had to shut it down at certain times of the year because it made the room so cold that the men could not work.

MR. NICHOLS: Are there any statistics showing the number of fires in kilns heated directly and the number of fires in kilns heated by the draw system?

MR. NEWELL: If you will write me a letter on that I will gladly send you the statistics that are available.

The National Electrical Code requires the installation of enclosed electrical motors in woodworking plants.

MR. BANASH: We have done considerable work on the temperatures to which wood should be allowed to be exposed continuously. I think in the Gas Safety Code we compromise with all interested at about 160° or 162° Fahrenheit for appliances which might expose woodwork. That was the maximum temperature which the woodwork should reach. We work that back to a rising temperature which approximately would give that instead of specifying the absolute temperature. I think in any wood-

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working code, we ought to say what is a reasonable, safe temperature to expose woodwork.

MR. NEWELL: The blower committee of the N. F. P. A. contemplates amending its rules to include data on the dust explosion hazard in general, so that it would apply to spice mills and various other kinds of mills. In the woodworking industry there might be grinding processes and other operations involving dust hazards which will be covered by the amended N. F. P. A. rules.

WOODEN GUARDS

CHAIRMAN PAINE: Mr. Newell, do you think that guards constructed of wood for belts and pulleys of woodworking machinery should be used in woodworking plants?

MR. NEWELL: I believe that would largely depend upon the type of building construction. If it was a frame building, it would simply add to the general combustibility, and it is a point you could readily eliminate. The fact that the building was sprinkled would have some bearing on it. I don't believe that you could lay down any rule and say that they shouldn't be installed.

CHAIRMAN PAINE: Do you know if there are any figures showing the numbers of fires due to friction or hot bearings, where the belts and pulleys have been practically enclosed by wooden guards?

MR. NEWELL: There are no such detailed figures.

MR. CLAUDE E. CONNALLY (Commissioner, Department of Labor, State of Oklahoma): What material would the Code Committee suggest in place of wood?

CHAIRMAN PAINE: Perforated metal, woven wire, expanded metal.

MR. CONNALLY: The open work in metal guards permits an accumulation of the refuse from the machine inside the guard. Where that refuse is combustible it might be very objectionable. Wooden guards might be satisfactory, however, if the bearings are left outside the guard.

MR. NEWELL: If in a totally unprotected building with open elevator shaft, open floors and no fire stops, poor type of skylights, and a poor exposure, then wood around transmission machinery would be an added hazard. But if, on the other hand, that building had all the structural weaknesses removed by adequate protection, supplemented by chemical extinguishers and a good type of automatic sprinkler system, it would seem to me that the boxing in of your transmission machinery would be of only minor importance.

MR. RIFFEL: Isn't it a fact that many people object to the wooden guard because it is usually so poorly constructed? The tendency is just to take some old boards and knock together any old thing. With metal, you have to use a little better construction.

CHAIRMAN PAINE: Mr. Keown (and I agree with him) has championed the idea that it is a mere theory that wooden guards increase the fire hazard to any considerable extent.

MR. H. G. WIBERG (Chief Engineer and Underwriter, Lumber Mutual Casualty Insurance Company, New York City): I don't believe that we

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can say that wooden guards in woodworking plants materially increase the fire hazard.

MR. E. F. ATWOOD (Industrial Inspector, State of Massachusetts, Duxbury, Mass.): I believe that a solid wood guard is satisfactory. It prevents refuse from entering inside the guard, and has no ledges for the accumulation of dust. I object to metal guards with openings because they catch dust and thereby increase the fire hazard greatly.

I think the main point in a woodworking establishment lies in the fact that a man has got the wood material in his establishment to construct that guard, and I think we would have a big problem to make a man install a metal guard in a woodworking establishment.

MR. KEOWN: I don't believe that a solid wooden guard is the thing at all. I know of at least one fire started from an overheated bearing inside of a solid wooden guard. It seems to me that there should be openings in it. It ought to be well constructed, according to the proposed standards that we have been working on in the Power Transmission code; it should have openings for ventilation.

MR. DICKINSON: I believe a solid wooden guard would be satisfactory if the bearings were placed outside the guard.

MR. W. F. CUMMINGS (U. S. Casualty Company, Boston): I have never yet found a wooden guard that has the durability of a metal guard. Then too, wooden guards do increase the fire hazard. Furthermore wooden guards take up more floor space and cannot be fastened as securely as metal guards. It is easy to construct metal guards (and impossible to construct wooden guards) with openings that are necessary for making adjustments.

MR. DICKINSON: I have seen hundreds of wooden guards in saw mills that I would stack up against any metal guard that has ever been turned out for wear and permanency or anything else. Many are reinforced with scrap iron. They will stand the test of time and abuse far better than expanded metal or angle iron guards, and it is far easier to hinge your wooden guard than it is to hinge your metal guard.

Properly built, the wooden guard has its field. I don't advocate them for general use, but in woodworking plants I believe most certainly they should be put in. Many woodworking plants are two hundred to five hundred, and perhaps a thousand miles, from a source of expanded metal and angle iron. They often haven't a man in the place who could make the guard if he had the material. Where they have thousands of feet of lumber in their yards and dozens of skilled woodworkers on the job, if they put up any guards at all, you may be sure they will be made of wood.

MR. B. H. SHELF (Travelers Insurance Company, Syracuse, N. Y.): I find that the fire insurance companies make a slight advance in the fire rate if the plant is entirely guarded with the use of wood.

(At this time Mr. Harry Guilbert took the chair and as the new chairman of the Woodworking Section appointed the following committees: bulletin committee chairman, Mr. E. Ross Farra, Mr. W. Graham Cole, and Mr. G. E. Sanford; program committee chairman, Mr. G. E. Sanford; Mr. R. McA. Keown, Mr. H. G. Wiberg.)

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SAFETY CODE FOR LOGGING OPERATIONS—CONSTRUCTION, OPERATION, AND MAINTENANCE OF LOGGING RAILROADS AND SAWMILLS

J. A. Dickinson, Mechanical Engineer, United States Bureau of Standards, Washington, D. C.

At the present time, there are about four hundred thousand men engaged in the primary manufacture of lumber. That includes the felling of trees, the transportation of logs by various methods, and the actual sawing and handling of the finished lumber. Every section of the United States produces some lumber, so it is evident that lumbering is a national industry in every sense of the word.

Some people have asked, "Are we ready for a logging code?" The answer to that is, yes. At the present time, there are only two states that have logging codes in operation, California and Washington. Fortunately, those two states are in practical accord on every point. Oregon is considering a code. Idaho expects to produce a code within the next year or two, and there is a possibility that Pennsylvania, New York, and some of the eastern and New England states will take up the question shortly. The southern states are almost without exception non-compensation states, but it will not be long before they too will be interested. The National Code, as it now stands, is practically in accord with the Washington and California codes, although we cover many more operations than they do.

In preparing this code, many interesting points have been considered. Perhaps the first point of interest is the question of axe and sledge handles. Strangely enough, we find that many minor accidents are caused by the breaking of these handles. The accidents resulting from broken pike poles do not occur as frequently as some of the other accidents, but the severity is high. A broken pike pole when a man is pushing a log means that he will probably fall into the splitter-head and receive a very serious if not fatal injury. We have tried to cover some of these points.

FACTOR OF SAFETY FOR CONVEYING CABLES

Another point that has started a controversy is the question of strength of cables used in conveying. Different men have suggested factors of safety ranging from 3 to 10. In our new draft of the code, we have followed the suggestion of one of the largest conveyor manufacturers in the United States; we recommend the seemingly low factor of safety of 3. This is based on the stalling power of the engine. In other words, if the load exceeds the maximum, it will stall the engine. That means a working factor of safety of approximately five.

The question of factors of safety in boilers in the woods is one that we have given considerable attention to. As a rule, the average logging locomotive does not come under the Interstate Commerce Commission, and in many cases does not come under the state boiler laws. The little portable boilers that are used for yarding, loading, and hauling may or may not. Some states exempt agricultural or portable boilers, others

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include them. Inasmuch as these requirements are not uniform, we had to include in the code a specification calling for a factor of safety of 4½ on boilers. This is practically in accord with the A. S. M. E. Boiler Code.

The speed of band saw mills has been discussed considerably. The band saws used in the ordinary saw mill will range from 6 to 11 feet in diameter and run at speeds varying from 7,000 to 11,500 feet per minute; in other words, from 1½ to 2 miles per minute. The tentative code gives 10,000 feet per minute as the maximum speed.

We are looking for additional material on dry kilns.

DISCUSSION

MR. ATWOOD: Does this Logging Code apply to all saw mills, no matter how small?

MR. DICKINSON: Originally, we exempted portable mills cutting less than 10,000 board feet per day. The code as it now stands applies to all saw mills regardless of their size.

MR. R. F. MILNE (Lumbermen's Safety Association of Canada, Ottawa, Can.): Some of the biggest firms in Canada have been operating band mills at 11,000 feet a minute. We know now that the quality is better and the quantity the same when operating at 9,000 feet per minute. Also there is less vibration.

MR. DICKINSON: Have you had any experience with the all steel wheels?

MR. MILNE: No.

MR. SELF: Does this code cover logging and saw mill operations in connection with paper mills?

MR. DICKINSON: I believe that the first part of our code covering logging, river driving, and transportation of logs is to be either taken over verbatim or used as the basis for that section of the Paper and Pulp Code.

What do you think of leaving the shaft driving the live rolls exposed provided your gears are covered? California requires the live roll shaft to be entirely enclosed and we have required it in our tentative code.

MR. MILNE: I think it is absolutely necessary to have it enclosed because I know of several cases where men were caught and pulled to pieces.

MR. CONNALLY: Our law in Oklahoma requires the operators to enclose such shafting.

MR. PAINE: In the Transmission Code we are insisting that those shaftings be guarded.

MR. MILNE: I would like to hear some of the men interested in saw mills express their views on a splitter behind a big saw, say a 60 inch saw. I consider the splitter desirable and necessary.

MR. DICKINSON: I believe that the splitters should be used, in fact, our code requires them.

ADJOURNMENT.

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INDEX

A. B. C. session, 121-142.
Abrasive Wheels:
Discussion, 155-156.
Use of Glass Guards (Discussion), 125.
"Why grinding wheels break" (Dodge), 149-154.
Absenteeism of Employees:
"Adequate records of lost time in industry due to sickness" (Newman), 296-303.
Experience of Hood Rubber Co., Watertown, Mass. (Discussion), 303-304.
Experience of Westinghouse Electric Co., Pittsburgh (Discussion), 305-306.
Accident Causes, see Classification of causes of accidents.
Accident Prevention:
"Accident Prevention from a medical standpoint" (Lipman), 499-503.
Accidents:
"Actual accident experience and its relation to insurance rates" (Kinghorn), 522-525.
Accidents—Statistics:
About coke ovens. In "Safe Practices in by-products coke plants," (Marquard), 380.
Accidents in American Steel & Wire Co., Worcester, Mass. In "Safe Practices in rolling mills" (Johnson), 387.
Airplane accidents. In "Report of Committee on Public Accident Statistics," 579.
Automobile and other traffic fatalities. In "Report of Committee on Public Accident Statistics," 575-577.
Bell Telephone Co. In "Development of accident prevention and first-aid work in the telephone field" (Downey), 660-661.
Burns. In "Safe Practices in pouring in foundry" (Root), 367-368.
Coupling and uncoupling. In "Coupling and uncoupling accidents" (LaFountaine), 786-788.
Drowning Statistics. In "Report of Committee on Public Accident Statistics," 577-578.
Elevator accident statistics. In "Report of Committee on Public Accident Statistics, 578-579.
Falls. In "Report of Committee on Public Accident Statistics," 577.
Handling billets. In "Safe Practices in rolling mills" (Johnson), 390.
In "Actual experience with a safety organization on a typical construction job" (Easterbrooks), 231.
In "Developing woodworking machinery to provide the highest degree of safety (Keown), 865.
In "Electric currents, falls of objects or persons" (Chapin), 806-809.
In "Getting on or off engines or cars, falling from engines or cars, struck or run over by engines or cars" (Harris), 803-805.
In "Handling freight supplies, materials, etc." (Pratt), 811-813.
In "Handling rails, ties, timbers, etc." (Astley), 809-811.
In "Organizing for Safety in a woodworking plant" (Guilbert), 859-860.
In "Safety engineering in the textile plant" (King), 819.
Loss due to faulty illumination, 81.
Lost time accidents in handling of gas from the coking of coal. In "Safe Practices in by-products coke plants" (Marquard), 383.
Massachusetts accidents, 854.
Metal mine fire fatalities. In "Fire prevention and fighting in metal mines" (Wolflin), 446.
Persons injured and killed by fires. in "Fire Prevention" (Fleming), 161.
Punch press accidents at the Simmons Co. In "Punch presses—designs of dies, automatic feeds, and safe guards" (Kaems), 172.
Railroads. In "Defects or failure of equipment" (Watkins), 757-758.
Railroads. In "Negligence of employees" (Mitchell), 754-757.
Railroads. In "Report of Committee on public accident statistics," 578.
Reductions in accidental deaths in St. Louis, 570.
Report of Committee on Public Accident Statistics, 573-580.
Reports of accidents from local council cities, 571-572.
Safety work brings 69% reduction in accidents. In "What's on my mind" (Cease), 796.
St. Louis schools, 38.
"Standard statistics for the rubber industry" (Watson), 683-686.
"Standardization of statistics" (Hawes), 182-184.
Train accidents for 1920 (Discussion), 754.
"What Baltimore and Ohio has done in safety." In "Importance of safety in railroad operation" (Galloway), 733-735; 739-740.
Acids:
"Safe practice in handling sulphuric acid" (Crass), 185-189.
"Actual accident experience and its relation to insurance rates" (Kinghorn), 522-525.

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Adams, Harry A., "Position, authority and responsibility of the safety officer," 744-747.
Airplanes, see Aviation.
Alford, L. P., "Increased production through accident prevention," 49-58.
American Rolling Mill Co. (Middletown, O.), improvements made by Dwight P. Robinson & Co., Inc. In "Actual experience with a safety organization on a typical construction job" (Easterbrooks), 227-231.
American Steel & Wire Co., South Works plant, Worcester, Mass., "Safe practices in rolling mills" (Johnson), 386-393.
Aniline & benzol products: "Hazards of aniline oil" (Discussion), 695.
"Animal haulage at anthracite coal mines" (Solomon), 410-414.
"Animal haulage in coal mines.' (Magraw), 414-420.
Annual Meeting of Members,
See Business Session.
Anthrax:
In "Health and sanitation in the tannery" (Pope), 531.
In "Occupational hazards incident to the tanning industry'. (Elder), 526-529.
Armstrong, Dr. Donald B., "What has been done for the health of the industrial worker in Framingham?" 114-119.
Astley, Harry A., "Handling rails, ties, timbers, etc.," 809-811.
Athletic organizations: "The safety man and athletics" (Discussions), 510-511.
Automobile headlights, see Headlights.
Automobiles:
Automobile and other traffic fatalities. In "Report of Committee on public accident statistics," 575-577.
Frequency that average steering gears and brakes need overhauling and replacement of certain parts (Discussion), 508.
Organization of schools for chauffeurs (Discussion), 355-357.
"Safe motor truck operation" (Cary), 505-508.
Automotive Section:
Minutes of meeting, 143-184.
Nominating committee report, 160-161.
Aviation:
Airplane accidents. In "Report of committee on Public Accident Statistics," 579.

"Baby clinics" (Dranga), 340-342.
Bair, E. L., "Upon whom does the burden fall when death or disability removes a producer from our midst?" 743-744.
Baker, John C. W., "Reclaiming plants and their efforts toward safe operation," 719-721.
Ballentine, J. E., "Mechanical safeguards," 519-521.
Banash, J. I., "Lessons learned from oxy-acetylene and other gas welding and cutting processes," 281-286.
Bartlett, D. K., "Handling liquid chlorine," 558-561.
Bauhan, A. E., "Hazards in hydro-electric plants," 631-643.
Beard, Harriet E., Discussion of Detroit's school accident prevention program, 239-242.
"Beater room hazards" (Walker), 552-553.
Belt Shifters:
Shipper lock and break on pin wheel. In "Mechanical safeguards" (Ballentine), 521.
Belting:
Convenient method of laying out belt and pulley guards, 122-123.
Tightening conveyor belts (Discussion), 386.
Benefit Associations, see Employees' Benefit Associations.
Benzol and aniline products—Care of workmen employed: Discussion, 205 205.
Benzol handling:
Discussion, 708-709.
In "Safe practices in by-products coke plants" (Marquard), 383-385.
"Safe handling of volatile liquids in rubber factories," 709-714.
Beyer, David S., Motion picture committee report, 594-595.
"Safety education through motion pictures," 177-180.
"Block signal and despatching in metal mines" (Murrill), 420-427.
Blood poisoning, see
Infection.
Boilers:
"Boilers and tanks or pressure vessels" (Morrison), 511-517.
Bonus systems in safety work:
Bonuses (Discussion), 465-467.
"Bonuses for good safety work. In "Safety organization and method of operating and maintaining interest among shift bosses and foremen" (Cowperthwaite), 461.
"Boosting safety through contractors' organizations" (Robinson), 211-214.
Boy Scouts of America:
Discussion, 590-591.
Report to the N. S. C. (Freeman), 589-590.
Bradford, Dr. C. L., "Diseases and injuries with symptoms referable to the lumbar spine," 329-335.
Bradley, John T., "Maintaining safety interest among miners," 462-464.
Brakes:
Discussion, 791.
"Operating hand brakes and hand switches" (Orr), 788-790.
Brennan, T. P., "Value of public bulletins as preventive measures," 776-779.
Broderick, John T.,
Chairman, Joint meeting of the Steam Railway Section and the Electric Railway Section, 767-813.
Building Construction, see
Construction.
Bulletin Boards:
In "How to promote safety education in a plant" (Regula), 139-140.
Bulletins:
Discussion, 548-549.
Home made bulletins, 45-46.
In "How to promote safety education in a plant" (Regula), 140-141.

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In "Safety engineering in the textile plant" (King), 821-822.
Safety bulletin—general round table, 45-48.
"Using a camera to promote safety" (Frampton), 543-547.
Value of bulletins (Discussion), 832-833.
"Value of public bulletins as preventive measures" (Brennan), 776-779.
Burns:
Accident statistics on burns in a foundry. In "Safe practices in pouring in a foundry" (Root), 367-368.
In "Occupational hazards incident to the tanning industry" (Elder), 527-528.
Treatment for caustic burns, 192-193.
Burrell, Guy H., "New developments in gas masks," 394-397.
Business and administration committee report (Worth), 17-18.
Business depression:
Discussion, 92-96.
"Need for accident prevention work and methods to be employed during the present industrial depression" (Worth), 86-92.
Business session, 5-31.
By-laws of N. S. C., Summary of amendments to, 24-31.

Cafeterias, see
Lunch rooms.
Camera, see
Photography.
Cameron, W. H., Committee on service to members, report, 16-17.
Campaigns:
"Attitude of the public toward the railway's participation in no-accident week campaigns" (Cullen), 253-256.
Burns recorded before and during a safety campaign in a foundry. In "Safe practices in pouring in a foundry" (Root), 367-368.
Fundamentals of a public safety campaign (Price), (Discussion), 357.
No-Accident week demonstrations (Discussion), 360.
Participation of electric railways in no-accident campaigns (Discussion), 257-258.
Results of a health campaign. In "Practical plans for medical supervision in rubber plants" (Quinby), 706-707.
Carrell-Dakin treatment:
In infection of industrial injuries" (Cotton), 317-318.
Carrow, Thomas H., Chairman, Steam Railroad Section, 723-813.
Cary, C. P., "Safe motor truck operation," 505-508.
Caustics:
Discussion, 192-193.
Cease, D. L., "What is on my mind," 793-802.
Centrifugal dryers, see
Extractors.
Chairs:
Discussion, 857-858.
"Industrial posture and seating," 845-850.
Chaney, Dr. Lucian W., "New safety code for woodworking plants," 882-883.
Chapin, E. S., "Electric currents, falls of objects or persons," 806-809.
Chauffeur schools, see
Automobiles.
"Chemical apparatus, Protection from excess pressures in" (Shaw), 194-198.
Chemical fire extinguishers:
Tags on fire extinguishers with warnings (Discussion), 164.
Chemical Industries:
"Centrifugal dryers or extractors" (Crass), 202-203.
"Protection from excess pressures in chemical apparatus" (Shaw), 194-198.
"Safe practice in handling sulphuric acid" (Crass), 185-189.
Chemical Section:
Minutes of meeting, 185-206.
Nominating committee report, 200.
"Chemists' standpoint, safety from" (Weber), 691-694.
Chesworth, William C., "Safety efficiency in relation to woodworking plants," 860-863.
Children, Safety work with:
"Outline of method of safety instructions in public & parochial schools" (Payne), 238-239.
Safety patrol work. In "Rejecting the Grundys from safety first," (Roadifer), 252.
see also "Boy Scouts of America."
Chlorine:
Chlorine gas dangerous though not poisonous (Discussion), 562-563.
Liquid chlorine vs. bleaching powder (Discussion), 562.
Size of containers and risks (Discussion), 563-564.
"Chlorine, Handling Liquid" (Bartlett), 558-561.
Clark, Dr. Irving:
"Discussion of Dr. White's paper on heart disease in industry," 313-316.
Classification of causes of accidents:
"An analysis of accident causes" (Lueck), 66-73.
Discussion, 73-75.
In "Fundamentals of safe guarding" (Sanford), 121.
"Standard statistics for the rubber industry" (Watson), 683-686.
"Use of protective devices" (Mac Lachlan), 669-672.
Clothing for industrial workers:
Safe clothing for men who grind caustics (Discussion), 192.
Coal—Handling—see
Handling materials.
Coal Storage:
"Risks in handling and storing coal, oil, and by-products" (Paige), 646-653.
Ventilating pipe (Discussion), 652-653.
Coke—Handling, see
Handling materials.
Coke ovens:

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In "Safe practices in by-products coke plants" (Marquard), 379-380.
Coke plants, By-products:
"Safe practices in by-product coke plants" (Marquard), 378-385.
Colburn, C. L., "Observations of a safety engineer in various coal and metal mining camps of U. S." (Abstracted), 468-471.
Colcord, Dr. A. W., Chairman, General session Health and Sanitation, 97-120.
Chairman, Health Service Section, 295-342.
Cole, John, "Public Safety," 39-42-44.
"Coming in contact with fixed structures" (Satterfield), 791-792.
Committees, Safety:
Activities of safety committees. In "Importance of safety in railroad operation" (Galloway), 734-735.
Discussion, 127-129.
Duties of the central safety committee, 54.
"Getting results from plant safety committee" (Salisbury), 125-127.
Keeping up interest in safety committees (Discussion), 825-826.
Maintenance of waymen on safety committees (Duscussion), 763.
"Compressed air haulage" (Johnson), 407-408.
Connelley, C. B., Rahabilitation, 658-659.
Construction:
"Actual experience with a safety organization on a typical contruction job" (Easterbrooks), 227-231.
"Boosting safety through contractors' organizations" (Robinson), 211-214.
"Co-operation of the sub-contractor in accident prevention" (Lewis), 225-226.
"Experience rating of contractors' risks" (Hall), 207-210.
"Mechanical safeguarding of equipment" (Talbot), 214-218.
"Protecting the public" (Risteen), 220-225.
Construction Section:
Appointment of nominating committeee, 207.
Minutes of meetings, 207-236.
Report of nominating committee, 220.
Statistical and standardization committee report number 2 on a standard list of causes for use in classifying accidents on construction work, 232-236.
Contests: Discussion, 568.
Coonley, Howard, "Address of Welcome," 5-7.
"Co-operation of the sub-contractor in accident prevention" (Lewis), 225-226.
Copp, Tracy:
Chairman, Women in Industry Section, 837-858.
Cotton, Dr. Frederick J. "Infection of industrial injuries," 316-318.
Coupling and uncoupling cars:
"Coupling and uncoupling accidents" (LaFountaine), 786-788.
Cox, Channing H., Address, 42-43.
Cowperthwaite, Thomas, "Safety organization and method of operating and maintaining interest among shift bosses and foremen," 459-462.
Cranes:
Cranes in by-product coke plants (Discussion), 386.
In "Safe practices in rolling mills" (Johnson), 389-390.
Crass, M. F., "Accident hazards in operating filter presses," 201-202.
"Centrifugal dryers or extractors," 202-203.
"Safe practice in handling sulphuric acid," 185-189.
Crum, F. S., "In Memoriam"—Resolution, 572-573.
Cullen, John E., "Attitude of the public toward the railway's participation in no-accident week campaigns," 253-256.
Cuspidors:
Paper cuspidors. In "Health and Sanitation in the tannery" (Pope), 532-533.

Dakin solution, see
Carrel-Dakin treatment.
Danger emblems:
Discussion, 483.
Daveler, E. V., "Storage battery locomotives in metal mines," 400-404.
Dayton Engineering Laboratories Co., "Industrial surgery and first-aid" (McCann), 174-177.
DeArmand, Louis, "Report of the Publicity Committee," 600-601.
DeBlois, L. A., Chairman, Engineering section, 281-294.
Demolition work, see
Wrecking.
Dermatoses:
In "Occupational hazards incident to the tanning industry" (Elder), 526.
Detroit General Builders' Association. In "Boosting safety through contractors' organizations" (Robinson), 211-214.
Detwiller, A. B., Discussion of Mr. Downey's paper, 664-665.
Dickinson, J. A., "Fundamental principles of safeguarding," 143-148.
"Safety code for logging operations—construction, operating, and maintenance of logging railroads and sawmills," 902-903.
"Direct hits in safety" (Kroes), 549-551.
Directors of N. S. C., Election of 23.
Diseases, Occupational:
"Duty of the states to include diseases of occupation under workmen's compensation" (Wilcox), 101-110.
Should disease of occupation be included under workmen's compensation (Discussion), 110-114.
Dodge, E. W., "Why grinding wheels break," 149-154.
Downey, F. M., "Development of accident prevention and first-aid work in the telephone field," 659-664.
Dranga, Amelia A., "Baby clinic," 340-342.

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Drinking water:
"Provisions for drinking water" (Yates), 481-482.
Drowning:
Accident statistics. In "Report of Committee on public accident statistics," 577-578.
Drummond, A. B., Chairman, Packers' and Tanners' Section, 499-537.
Dryers, Centrifugal, see
Extractors.
Dust:
"Dust explosions — their nature, causes, and methods of prevention," 165-171.

Easterbrooks, P. B., "Actual experience with a safety organization on a typical construction job," 227-231.
Economics, see
Production increased by accident prevention.
Education of workmen:
Expense of foremen's schools (Discussion), 348.
In "Safe practice in rolling mills" (Johnson), 391-393.
Organization of foremen's schools (Price) (Discussion), 345-347.
Education, Safety:
Continuation schools to teach safety (Discussion), 832.
"How to promote safety education in a plant" (Regula), 138-142.
"Safety education through motion pictures" (Beyer), 177-180.
"Safety instruction in public and parochial schools" (Payne), 33-39.
Education Section:
Election of officers, 248.
Minutes of meetings, 237-248.
Elder, Dr. Fred O., "Occupational hazards incident to the tanning industry," 526-529.
Electric Railway Section:
Joint meeting with Steam Railway Section, 767-813.
Minutes of meeting, 249-265.
Nominating committee, 249-253.
Electric Railways:
"Attitude of the public toward the railway's participation in no-accident week campaigns" (Cullen), 253-256.
One-man safety cars have fewer accidents than two-man cars (Discussion), 258-259.
"Rejecting the Grundys from safety first" (Roadifer), 249-252.
"Standardizing railroad crossing signs and grade crossings" (Messenger), 259-265.
"Electrical hazards in foundries and steel mills" (Greenwood), 372-376.
Electricity:
"Care in the construction and maintenance of overhead lines" (Gates), 674-680.
Discussion, 161.
"Electrical hazards and proper installation of equipment" (Pefferly), 156-160.
"Electrical hazards in foundries and steel mills" (Greenwood), 372-376.
"Hazards in hydro-electric plants" (Bauhan), 631-643.
Highest voltage a man can take with wet hands (Discussion), 643.
Electricity in Mines:
"Advantages of trolly locomotives for underground haulage from a safety standpoint" (Whiteside), 404-406.
"Storage battery locomotives in metal mines" (Daveler), 400-404.
Elevators:
Accident statistics. In "Report of Committee on public accident statistics," 578-579.
Elevator hazards committee report, 584-589.
Elevator hinge platform in floor sections. In "Mechanical safeguards" (Ballentine), 521.
Inspection forms. In "Elevator hazards committee report," 586-587.
Lessons in safety for elevator operators. In "Elevator hazards committee report," 587-589.
Rules for elevator operators. In "Elevator hazards committee report," 585-586.
"Elimination of steam during pouring" (Shaw), 368-372.
Elzy, E. P., "Report of Committee on Elevator Hazards," 584-589.
Emblem, Danger, see
Danger emblem.
Employees' Benefit Associations:
Best methods of obtaining and maintaining membership (Discussion), 267-274.
Bethlehem Steel Co. compulsory membership and cost (Discussion), 267-268.
"Comparison of statistics on frequency and severity of sick and death cases as covered by relief association" (Discussion), 277-280.
"Desirability of part contribution by employes in supporting finances of relief and beneficial associations" (Discussion), 274-277.
Experience of Westinghouse Electric Co., Pittsburgh (Discussion), 306.
Employees' Benefit Association's Round Table Luncheon:
Appointment of committee to consult with N. S. C. officers with a view toward forming a permanent section and Program for 1922, 279.
Minutes, 267-280.
"The Engineering Factor" (Forster), 60-66.
Engineering Section:
Minutes of meeting, 49-75; 281-294.
Engineering Section:
"Safety engineering in the textile plant" (King), 819-823.
Safety Engineers' duties," 54.
Entertainments:
"Direct hits in Safety" (Kroes), 549-551.
Safety rallies with entertainment features aid in interesting men in safety," 132.
"Social phase of safety work" (Rosebush), 565-567.
"Essentials of a plant safety organization" (Tinsley), 129-132.

Digitized by Google

Examinations, Physical, see
Physical examination of employees.
Excavation work:
In "Protecting the public" (Risteen), 221-222.
Executives, see
Management.
Exhaust systems, see
Ventilation and exhaust systems.
"Experiences rating of contractors' risks" (Hall), 207-210.
"Experiences in a coal mine fire" (Gillette), 442-445.
Explosives:
Thawing dynamite (Discussion), 219-220.
Extractors:
"Centrifugal dryers or extractors (Crass), 202-203.
Eye Protection:
Statistics of eye injuries, 55-56; 79. see also—Goggles.

Factory Management:
"Safety first from the factory manager's view-point" (Whittelsey), 716-719.
Falls:
Accident statistics. In "Report of Committee on Public Accident statistics," 577.
Fall (Materials):
In "Electric currents, falls of objects or persons" (Chapin), 806-809.
Fall (People):
In "Electric currents, fall of objects or persons" (Chapin), 806-809.
Farra, E. Ross, Chairman, Woodworking Section, 859-903.
Fatigue:
Discussion (Wright), 843-844.
"Fatigue study—a first step in safety work" (Gilbreth), 837-843.
Filter presses:
"Accident hazards in operating filter presses" (Crass), 201-202.
Fire Prevention:
"Experiences in a coal mine fire" (Gillette), 442-445.
"Fire hazards in woodworking plants" (Newell), 890-898.
"Fire hazards of rubber factories dependent on humidity" (Hoxie), 687-688.
"Fire prevention" (Fleming), 161-164.
"Fire prevention and fighting in anthracite mines" (Jacobs), 430-433.
"Fire prevention and fighting in metal mines" (Wolflin), 445-453.
"Fire prevention and fighting in the anthracite mines" (Otto), 434-437.
How to extinguish coke fire (Discussion), 164-165.
In woodworking plants (Discussion), 899.
"Mine fire prevention and fighting in bituminous coal mines" (Reed), 437-442.
"Risks in handling and storing coal, oil, and by-products" (Paige), 646-653.
Use of gas analysis in fighting fires (Discussion), 453-454.
First Aid:
Contents of first-aid kit. In "Safety efficiency in relation to woodworking plants" (Chesworth), 863.
"Development of accident prevention and first-aid work in the telephone field" (Downey), 659-664.
Discussion, 665.
Discussion of methods, 176-177.
"First aid stations underground" (Sayers), 484-488.
First aid stations underground (Discussion), 488-489.
"Industrial surgery and first-aid" (McCann), 174-177.
"Transportation of the injured in the mining industry" (Sayers), 323-329.
Types of splints (Discussion), 335.
First Aid Contests:
Rules governing first-aid contests, 496-498.
"Standardization of first-aid and first-aid contests, with lists of qualified professional and lay judges" (Shields), 495-498.
Fisher, Boyd, "What a service manager thinks of safety," 833-835.
Fitzgerald, E. H., Chairman, Rubber Section, 683-722.
Fleming, T. Alfred, "Fire prevention," 161-164.
Floors:
Corrugated floors in tacking room in a tannery (Discussion), 534.
Floor of color room (Discussion), 831.
How to prevent slipping on floors. In "Safety engineering in the textile plant" (King), 820.
Fonda, George T.,
Chairman, Employees' Benefit Association round table luncheon, 267-280.
Chairman, General Round Table. The safety bulletin, 45-48.
Foreman and subforemen:
Duties of foremen and sub-foremen, 54.
Entertainment at foremen schools, 348-350.
Expense of foremen's schools (Discussion), 348.
"The foremen—the determining factor" (Gilbert), 134-137.
"Managers' and foremen's responsibilities" (Murbach), 541-543.
Organization of foremen's schools (Price) (Discussion), 345-347.
Qualifications of a good foreman. In "Managers' and foremen's responsibilities" (Murbach), 542-543.
Success of safety work depends on foremen and doctor. In "Accident prevention from a medical standpoint" (Lipman), 500-502.
Forster, H. W., "The engineering factor," 60-66.
Foundries:
Cable slings or chains for handling hot loads in foundry (Discussion), 376.
"Electrical hazards in foundries and steel mills" (Greenwood), 372-376.
"Elimination of steam during pouring" (Shaw), 368-372.
"Safe practices in pouring in a foundry" (Root), 365-368.

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Fox, F. F., Discussion of Mr. Chasworth's paper, 863-865.
Framingham Community Health and Tuberculosis Demonstration:
In "What has been done for the health of the industrial worker in Framingham?" (Armstrong), 114-119.
Frampton, A. E., "Using a camera to promote safety," 543-547.
Freeman, J. P., "Report of the Boy Scouts of America to the N. S. C., 589-590.
Fumes and vapors, irritating:
Discussion, 191.
"Fundamental principles of safeguarding" (Dickinson), 143-148.
"Fundamentals of safeguarding" (Sanford), 121-125.

Galloway, C. W., "Importance of safety in railroad operation," 731-742.
Ganzert, W. H., "Working machinery; use of hand tools. burns; scalds and punctures," 805-806.
Gas Holders:
In "Risks in handling and storing coal, oil, and by-products" (Paige), 651.
Gas masks, see
Masks.
Gasoline, Use of:
"Safe handling of volatile liquids in rubber factories," 709-714.
Gates, A. B., "Care in the construction and maintenance of overhead lines," 674-680.
Gates—Hydraulic. In "Hazards in hydro-electric plants" (Bauhan), 642.
Gears—Safeguarding:
Discussion, 148.
General Managers' report, N. S. C., (Price), 11-15.
General Round Table session, 45-48.
General sesson on Public Safety & Education, 33-44.
"Getting results from plant safety committees" (Salisbury), 125-127.
Gilbreth, F. B., and Gilbreth, Lillian M.,
"Fatigue study—a first step in safety work," 837-843.
Gillette, G. M., "Experiences in a coal mine fire," 442-445.
Gloves:
Ruber, leather, and canvas gloves versus protective preparations (Discussion), 206.
Should warmers and mixers in the rubber industry wear gloves? (Discussion), 690.
Goggles:
Use for caustic workers (Discussion), 204.
Grade Crossings:
Accidents. In "Importance of safety in railroad operation" (Galloway), 735-736; 738-741.
Accidents. In "Value of public bulletins as preventive measures" (Brennand, 777-778.
Bumps as deterrents to careless motorists" (Discussions), 782.
Committee on highway grade crossing accidents of A. R. A., 767.
Discussion, 774-775; 784-785.
"Gates, distance signs, and crossing watchmen as protection at highway grade crossings" (Metcalfe), 768-771.
Law of Illinois, 783-784.
"Safety at highway crossings through legislation" (Ridgway), 779-782.
"Standardizing railroad crossing signs and grade crossings" (Messenger), 259-265.
Grade Crossings—Signs and Signals:
Discussion, 771-773.
"Gate, distant signs, and crossing watchmen as protection at highway grade crossings" (Metcalf), 768-771.
Greenwood, Walter, "Electrical hazards in foundries and steel mills," 372-376.
Grinding wheels, see
Abrasive wheels.
Group Insurance, see
Insurance, Group.
Guards for machinery, see
Safe guarding.
Guilbert, Harry, "The foreman—the determining factor," 134-137.
"Organizing for safety in a woodworking plant," 859-860.

Hall, L. L., "Experience rating of contractors' risks," 207-210.
Handling materials:
Coal handling. In "Safe practices in by-product coke plants" (Marquard), 378.
Handling billets. In "Safe practice in rolling mills" (Johnson), 390.
"Handling liquid chlorine" (Bartlett), 558-561.
"Risks in handling and storing coal, oil, and by-products" (Paige), 646-653.
Harris, E. M., "Getting on or off engines or cars, falling from engines or cars, struck or run over by engines or cars," 803-805.
Hawes, George H., "Standardization of statistics," 182-184.
Head Gates, see
Gates, Hydraulic.
Headlights:
Minneapolis headlight focusing station, 613-615.
Regulation of headlights in Milwaukee (Rumsey) (Discussion), 615-616.
Health and Sanitation, Meeting of, General session, 97-120.
"Health and Sanitation in the Tannery" (Pope), 530-534.
"Health hazards in the rubber industry—Report" (Horan), 714-715.
Health in schools, Teaching, 340.
Health Service Section:
Appointment of nominating committee, 296.
Minutes of meeting, 295-342.
Health supervision of employees:
"Accident prevention from a medical standpoint" (Lipman), 499-503.
"Adequate records of lost time in industry due to sickness" (Newman), 296-303.

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In "What has been done for the health of the industrial worker in Framingham?" (Armstrong), 117-118.
"Industrial surgery and first-aid" (McCann), 174-177.
"Practical plans for medical supervision in rubber plans" (Quinby), 701-707.
"The work-day and industrial health" (Spaeth), 97-100.
Heart Disease:
"Discussion of Dr. White's paper on heart disease in industry" (Clark), 313-316.
"Problem of heart disease in the industrial worker" (White), 306-313.
Hitchcock, Thomas B. "Textile safety code," 815-818.
Holcomb, Rev. Walt., Address, 729-731.
Hours of labor:
"Work-day and industrial health" (Spaeth), 97-100.
Housekeeping, Shop:
"Keeping a rubber factory clean" (Jameson), 696-701.
"How to promote safety education in a plant" (Regula), 138-142.
Hoxie, F. S., "Fire hazard of rubber factories dependent on humaidity," 687-688.
Hydro-Electric plants:
Discussion (Moorse), 644-645.
"Hazards in hydro-electric plants" (Bauhan), 631-643.

Ilumination:
"Better industrial lighting — how?" (Turner), 82-86.
"Better indusrial lighting — Why?" (Shenton), 77-82.
see also—Lighting.
Infection:
"Discussion of Dr. Cotton's paper on infection" (Morehead), 318-322.
"Infection of industrial injuries" (Cotton), 316-318.
see also, Burns.
Ingham, Sydney, "Accident hazards in the textile industries and ways of meeting them," 826-831.
Injured workmen—see
workmen, Injured.
Inspection:
In "Hazards in hydro-electric plants" (Bauhan), 632-633.
Instruction of workmen—see
Education of workmen.
Insurance—Accident:
"Actual accident experience and its relation to insurance rates" (Kinghorn), 522-525.
Reduction in rates (Discussion), 523-525.
Insurance, Group:
Discussion, 536.
Interest in safety work, How to maintain (Discussion), 825.
"Direct hits in safety" (Kroes), 549-551.
"How to promote safety education in a plant" (Regula), 138-139.
In "Essentials of a plant safety organization" (Tinsley), 131-132.
Iron and Steel Industry:
"Electrical hazards in foundries and steel mills" (Greenwood), 372-376.

Jacobs, W. L., "Fire prevention and fighting in anthracite mines," 430-433.
Jameson, William, "Keeping a rubber factory clean," 696-701.
Johnson, Ethel M., Discussion of Ida Tarbell's paper, 854-856.
Johnson, Fred, "Safe practices in rolling mills," 386-393.
Johnson, G. J. "Compressed air hauling," 407-408.

Kaems, August L., "Punch presses—design of dies, automatic feeds, and safeguards," 171-173.
Keene, G. R., "Mechanical side of accident prevention in the packing industry," 503-505.
"Keeping a rubber factory clean" (Jameson), 696-701.
Keown, R. McA., "Designing woodworking machinery to provide the highest degree of safety," 865-871.
Kepner, Ira V., Chairman, Chemical Section, 185-206.
Publicity committee report, 20-21.
Kershaw, S. H., Chairman, A. B. C. Session, 121-142.
King, Everett F., "Safety engineering in the textile plant," 819-823.
Kinghorn, W. B., "Actual accident experience and its relation to insurance rates," 522-525.
Koehler, A. W., Discussion of Rochester school accident prevention program, 245-248.
Kohler, Dr. C. H., "Pedestrian hazard committee report," 604-605.
Kroes, Al., "Direct hits in safety," 549-551.

Ladders:
Construction of ladders. In "Traveling ways and signs" (Seip), 473-475.
La Fountaine, C. L., "Coupling and uncoupling accidents," 786-788.
Lanterns, see
Safety lamps.
Latrines:
Discussion, 494-495.
Laws, Traffic, see Traffic.
Lee, Robert E., "Success in vigilante work," 607-609.
Lewis, A. H., "Co-operation of the subcontractor in accident prevention," 225-226.
Lewis, Dr. Warren K., "Safety in the evaporation of volatile solvents," 288-293.
Lighting:
Better industrial lighting — how?" (Turner), 82-86.
Better industrial lighting — why?" (Shenton), 77-82.
Hydro-electric plants (Discussion), 645.
In "Hazards in hydro-electric plants" (Bauhan), 641.
Requirements for good lighting, 56.
Linemen—Protection:
Grounding chains. In "Use of protective devices" (Maclachlan), 670.
Linemen—Safety for:
"Care in the construction and maintenance of overhead lines" (Gates), 674-680.

Digitized by Google

Lipman, Dr. W. H., "Accident prevention from a medical standpoint," 499-503.
Local Councils:
Financing a local council, 360-363.
National Safety Council aid to local councils (Price) (Discussion), 352-353.
Officers' sessions, 343-364.
Organization (Price), 344-345.
Organization of foremen's schools (Price), 345-347.
Organization of public safety division of local council (Discussion), 353-355.
Success of local council affiliations with business organizations (Price), 343-344.
Local development and public safety committee report (Oartel), 18-20.
Locomotives:
"Advantages of trolley locomotives for underground haulage from a safety standpoint" (Whiteside), 404-406.
"Compressed air hauling" (Johnson), 407-408.
Dangers of trolley locomotives (Discussion), 428-429.
Disadvantages of compressed air locomotive (Discussion), 428.
Distances storage battery locomotive could be used (Discussion), 428.
"Storage battery locomotives" (Stuart), 408, (Abstact.)
"Storage battery locomotives in metal mines" (Daveler), 400-404.
Logging:
Code (Discussion), 903.
"Safety code for logging operations—construction, operation and maintenance of logging railroads and sawmills" (Dickinson), 902-903.
Lucas, H. C., Discussion of Mr. Scott's paper, 628-629.
Lueck, H. W., "An analyisis of accident causes," 66-73.
Lunch rooms:
Cafeteria (Discussion), 535.

McCampbell, T. R., "Defects in or improper maintenance of way and structures," 759-762.
McCann, Dr. T. A., "Industrial surgery and first-aid," 174-177.
Maclachlan, Wills, "Use of protective devices," 669-672.
McClellan, Dr. William, Speech at "Get together luncheon," 654-657.
Magraw, R. M., "Animal haulage in coal mines," 414-420.
"Maintaining interest among shift bosses and foremen, safety organization and method of operating" (Cowperthwaite), 459-462.
"Maintaining safety interest among executives" (Moulton), 456-459.
"Maintaining safety interest among miners" (Bradley), 462-464.
Mallon, J. H., Chairman, Electric Railway Section, 249-265.
Management:
Discussion of Mr. Scott's paper (Lucas), 628-629.
"Maintaining safety interest among executives" (Moulton), 456-459.
"Managers' and foremen's responsibilities" (Murbach), 541-543.
"Necessity of the support of executives in accident prevention work" (Scott), 624-628.
"Safety first from the factory manager's viewpoint" (Whittelsey), 716-719.
"Managers' and foremen's responsibilities" (Murbach), 541-543.
Manufacturing Sections:
Joint meeting, 77-96.
Marquard, F. F., "Safe practices in by-products coke plants," 378-385.
Masks:
Discussion, 397-398.
"New developments in gas masks" (Burrell), 394-397.
Use of army gas mask for worker with chlorine (Discussion), 564.
Meat Packers' Section, see Packers' and Tanners' Section.
"Mechanical safeguarding of equipment" (Talbot), 214-218.
"Mechanical safeguards" (Ballentine), 519-521.
"Mechanical side of accident prevention in the packing industry" (Keene), 503-505.
Medical supervision, see Health supervision of employees; physical examination of employees.
Meetings of foremen, see Foremen and subforemen.
Members, Annual meeting, see Business session.
Memberships committee reports of sections, see name of section, sub heads; membership committee reports.
Messenger, R. S., "Standardizing railroad crossing signs and grade crossings," 259-265.
Metal mining, see Mines and Mining, Metal.
Metals Section:
Appointment of nominating committee, 365.
Minutes of meeting, 365-398.
Report of nominating committee, 386.
Metcalfe, F. M., "Gates, distant signs, and crossing watchmen as protection at highway grade crossings," 768-771.
Mine car:
Sprags vs. brake. In "Animal haulage in coal mines" (Magraw), 416-417.
Mines & Mining:
"Advantages of trolley locomotives for underground haulage from a safety standpoint" (Whiteside), 404-406.
Animal haulage (Discussion), 420.
"Animal haulage at anthracite coal mines" (Solomon), 410-414.
"Animal haulage in coal mines" (Magraw), 414-420.
"Compressed air haulage" (Johnson), 407-408.
Cost of haulage (Discussion), 408-409.
"Experiences in a coal mine fire" (Gillette), 442-445.
"Fire prevention and fighting in anthracite mines" (Jacobs), 430-433.

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"Fire prevention and fighting in the anthracite mines" (Otto), 434-437.
"First aid stations underground" (Sayers), 484-488.
Ignition of gases by spars (Discussion), 429.
"Maintaining safety interest among executives" (Moulton), 456-459.
"Maintaining safety interest among miners" (Bradley), 462-464.
"Mine fire prevention and fighting in bituminous coal mines" (Reed), 437-442.
"Observations of a safety engineer in various coal and metal mining camps of U. S." (Colburn), (Abstracted,) 468-471.
"Provisions for drinking water" (Yates), 481-482.
"Safety organizations and method of operating and maintaining interest among shift bosses and foremen" (Cowperthwaite), 459-462.
"Standardization of first-aid and first aid contents with list of qualified professional and lay judges (Shields), 495-498.
"Storage battery locomotives" (Stuart), (Abstract), 408.
Tracks. In "Animal haulage in coal mines" (Magraw), 417-419.
"Transportation of the injured in the mining industry" (Sayers), 323-329.
"Traveling ways and signs" (Seip), 471-481.
"Underground toilets and sewage disposal for mines" (Williams), 489-494.
Mines and Mining—Metal:
"Block signal and despatching systems in metal mines" (Murrill), 420-427.
"Fire prevention and fighting in metal mines" (Wolflin), 445-453.
"Storage battery locomotives in metal mines" (Daveler), 400-404.
"Underground toilets and sewage disposal for mines" (Williams), 489-494.
Use of liquid carbon dioxide in mine fire. In "Fire prevention and fighting in metal mines" (Wolflin), 448-449.
Mines and Mining—Signs and Signals:
"Block signal and dispatching sys- in metal mines" (Murrill), 420-427.
Mining Section:
Appointment of nominating committee, 400.
Delegates, 399-400.
Election of officers, 455.
Minutes of meeting, 399-498.
Mitchell, F. W., "Negligence of employees," 754-757.
Moore, John F., "Safety first—from a moral viewpoint," 725-729.
Moorhead, Dr. J. J., "Disucssion of Dr. Cotton's paper on infection," 318-322.
"Moral viewpoint, Safety first from" (Moore), 725-729.
Morey, A. T., Chairman, Education Section, 237-248.
Morris, F. E., Discussion of Syracuse school accident prevention program, 243-245.
Morrison, C. E., Chairman, Public Utilities Section, 621-682.
Morrison, J. P., "Boilers and tanks on pressure vessels," 511-517.
Moulton, W. H., "Maintaining safety interest among executives," 456-459.
Moving Pictures in safety work:
(Discussion), 180-182; 595-600.
Motion picture committee report, 594-595.
"Safety education through motion pictures" (Beyer), 177-180.
Murbach, Roy J., "Managers' and foremen's responsibilities," 541-543.
Murrill, R. T., "Block signal and dispatching in metal mines," 420-427.
Musical organizations:
Commonwealth Edison Co., orchestra (Discussion), 511.

Nail hazards:
(Discussion), 219.
"Need for accident prevention work and methods to be employed during the present industrial depression" (Worth), 86-92.
"Negligence of employees" (Mitchell), 754-757.
New Employees:
General Electric Co., Lynn, Mass., 128.
"How to promote safety education in a plant" (Regula), 138-139.
Newell, H. E., "Fire hazards in woodworking plans," 890-898.
Newman, Bernard J., "Adequate records of lost time in industry due to sickness," 296-303.
Nichols, H. M., "Exhaust systems for woodworking machines, 871-873.
No-Accident camgaigns, see Campaigns.
Nurses:
Visiting nurse (Discussion), 531-535; 537.

Oartel, John A.:
Chairman, Metal Section, 365-398.
Local development and public safety committee report, 18-20.
"Safety and production from the practical viewpoint," 58-59.
Occupational diseases, see Diseases, Occupational; Tuberculosis.
"Occupational hazards incident to the tanning industry" (Elder), 526-529.
Oil—Handling, see Handling Materials.
Oil storage:
"Risks in handling and storing coal, oil, and by-products" (Faige), 646-653.
Organization, Safety:
"Actual experience with a safety organization on a typical consruction job (Easterbrooks), 227-231.
"Boosting safety through contractors' organizations" (Robinson), 211-214.
"Development of accident prevention and first-aid work in the telephone field" (Downey), 659-664.
"Essentials of a plant safety organization" (Tinsley), 129-132.
In "Safe practices in rolling mills" (Johnson), 391-393.

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"Organizing for safety in a woodworking plant" (Guilbert), 859-860.
"Position, authority and responsibility of the safety officer" (Adams), 746-747.
"Safe practices in pouring in a foundry" (Root), 365-368.
"Safety organization and method of operating and maintaining interest among shift bosses and foremen" (Cowperthwaite), 459-462.
"Social phases of safety work, (Rosebush), 565-567.
"What is on my mind", (Cease), 793-802.
see also Committees, Safety.
Orr, W. J., "Operating hand brakes and hand switches," 788-790.
Orris, George, "Guarding woodworking machines from the viewpoint of the operator," 888-889.
Osgood, Dr. Robert, "Discussion of Dr. Bradford's paper," 335-340.
Otto. H. H., "Fire prevention and fighting in the anthracite mines," 434-437.
Oxy-acetylene welding and cutting:
"Lessons learned from oxy-acetylene and other gas welding and cutting processes" (Banash), 281-286.
Quality and size of hose. In "Lessons learned from oxy-acetylene and other gas welding and cutting processes" (Banash), 284.
Various accidents described (Discussion), 286-288.

Packers' and Tanners' Section:
Minutes of meeting, 499-537.
Nominating Committee's report, 510.
Packing Houses:
"Mechanical side of accident prevention in the packing industry" (Keene), 503-505.
Packing house tanks. In "Boilers and tanks or pressure vessels" (Morrison) 515-517.
Tanks in packing house (Discussion), 518.
Paige. C. E., "Risks in handling and storing coal, oil, and by-products," 646-653.
Paper and Pulp Industry:
"Beater room hazards" (Walker). 552-553.
"Ventilation of paper mills from a building and safety standpoint" (Taylor), 554-558.
Paper and Pulp Section:
Annual reports, 539-540.
Appointment of nominating committee, 543.
Minutes of meeting, 539-568.
Nominating committee report, 553.
Payne. Dr. E. George, "Outline of method of safety instruction in public and parochial schools," 238-239.
"Report of Committee on school hazards," 581.
"Safety instruction in public and parochial schools," 33-39.
Pefferly, W. J., "Electrical hazards and proper installation of equipment, 156-160.
Photography:
Discussion, 547-549.
"Using a camera to promote safety" (Frampton), 543-547.
Physical examination of employees:
In "What has been done for the health of the industrial worker in Framingham?" (Armstrong), 117.
Organization of medical department (Discussion), 119-120.
Picnics: "No-Accident picnic. In "Social phases of safety work" (Rosebush), 565-567.
Pope, P. E., "Health and sanitation in the tannery," 530-534.
"Position, authority and responsibility of the safety officer" (Adams), 744-747.
Posture: "Industrial posture and seating" (Swartz), 845-850.
Power Presses:
"Punch presses—designs of dies, automatic feeds, and safe guards" (Kaems), 171-173.
Special devices for safeguarding (Discussion), 173.
Pratt. J. T., "Handling freight supplies, materials, etc." 811-813.
President's annual address: (Tolman), 7-11.
Presses—Power—see Power Presses.
Presses—Punch—see Power Presses.
Presses—Filter—see Filter Presses.
Price, C. W.,
Chairman, Local Council officers meeting, 343-364.
Report of the General Manager, 11-15.
Price, David J., "Dust explosions—their nature, causes, and methods of prevention," 165-171.
Production increased by accident prevention:
"Increased production through accident prevention" (Alford), 49-58.
"Safety and production from the practical viewpoint" (Oarte,l) 58-59.
Prone pressure method of artificial respiration—see Resuscitation.
"Protecting the public" (Risteen), 220-225.
"Protective devices, Use of" (Maclachlan), 669-672.
Public Safety:
Accident report forms. In "Report of committee on public accident statistics," 579-580.
Getting business concerns to pay bills for safety publicity" (Discussion), 602.
Making safety propaganda live news from the city editor's standpoint (Discussion), 603-604.
"Public Safety" (Cole), 39-42; 44.
Report of Committee on public accident statistics, 573-580.
Report of Secretary of Public Safety Section, 569-571.
Safe Drivers' Clubs (Discussion), 616-620.
Public Safety Section:
Appointment of nominating committee, 572.
Election of officers, 589.
Elevator hazards committee report, 584-589.

Digitized by Google

Minutes of meeting, 569-620.
Motion picture committee report, 594-595.
Pedestrian hazard committee report (Kohler), 604-605.
Publicity Committee report, 600-601.
School hazards committee report (Payne), 581.
Secretary's report, 569-571.
"Success in vigilante work" (Lee), 607-609.
Public Utilities:
"Hazards in hydro-electric plants" (Bauhan), 631-643.
"Necessity of the support of executives in accident prevention work" (Scott), 624-628.
"Risks in handling and storing coal, oil and by-products" (Paige), 646-653.
Public Utilities Section:
Appointment of nominating committee, 630.
Delegates attending, 621-624.
Election of officers, 658.
Get-together luncheon, 654-658.
Minutes of meeting, 621-682.
Publicity Committee report (Kepner), 20-21.
Pulleys: Convenient method of laying out belt and pulley guards, 122-123.
Punch Presses, see
Power Presses.

Quinby, Dr. Robert S., "Practical plans for medical supervision in rubber plants," 701-707.

Railroads—Safety:
Accident Statistics. In "Report of Committee on public accident statistics," 578.
Address (Holcomb), 729-731.
"Coming in contact with fixed structures" (Satterfield), 791-792.
"Coupling and uncoupling accidents" (La Fountaine), 786-788.
Discussion, 762-765.
Discussion of Mr. Cease's paper, "What is on my mind," 802-803.
"Defects in or improper maintenance of way and structures" (McCampbell), 759-762.
"Defects or failure of equipment" (Watkins), 757- 758.
"Electric currents, falls of objects or persons" (Chapin), 806-809.
"Gates, distant signs, and crossing watchmen as protection at highway grade crossings" (Metcalfe), 768-771.
"Getting on or off engines or cars, falling from engines or cars, struck or run over by engines or cars" (Harris), 803-805.
"Handling freight supplies, materials, etc." (Pratt), 811-813.
"Handling rails, ties, timbers, etc." (Astley), 809-811.
"Importance of safety in railroad operation" (Galloway), 731-742.
"Operating hand brakes and hand switches" (Orr), 788-790.
"Position, authority and responsibility of the safety officer" (Adams), 744-747.
Position of safety officer (Discussion), 748-753.
"What is on my mind?" (Cease), 793-802.
Rating—Experience:
"Experience rating of contractors' risks" (Hall), 207-210.
Razing, see Wrecking.
"Reclaiming plants and their efforts toward safe operations" (Baker), 719-721.
Reed, J. W., "Mine fire prevention and fighting in bituminous coal mines," 437-442.
Regula, A. S., "How to promote safety education in a plant," 138-142.
"Rejecting the Grundys from safety first" (Roadifer), 249-252.
Report Forms:
Accident report forms. In "Report of Committee on Public Accident Statistics," 579-580.
Elevator inspection report forms. In "Elevator hazards committee report," 586-587.
Resolutions, 21-22.
Resolutions Committee Report:
"In Memoriam, Frederick S. Crum," 572-573.
Resposibility for Accidents:
"The Engineering factor" (Forster), 60-66.
"Increased production through accident prevention" (Alford), 49-58.
"Safety first from a moral viewpoint" (Moore), 725-729.
"Upon whom does the burden fall when death or disability removes a producer from our midst?" 743-744.
Resuscitation: Discussion, 681.
Prone pressure for public utilities (Discussion), 665-669.
Successful use (Discussion), 673.
Ridgway, Arthur, "Safety at highway crossings through legislation," 779-782.
Risteen, A. D., "Protecting the public," 220-225.
Roadifer, Laura, "Rejecting the Grundys from safety first," 249-252.
Robinson, Frank S., "Boosting safety through contractors' organizations," 211-214.
Rolling mills: "Safe practices in rolling mills" (Johnson), 386-393.
Root, A. B., Jr., "Safe practices in pouring in a foundry," 365-368.
Rosebush, F. H., "Social phases of safety work," 565-567.
Rubber Industry:
Compounding materials. In "Safety—from the chemist's standpoint" (Weber), 691-692.
"Fire hazard of rubber factories dependent on humidity" (Hoxie), 687-688.
"Hazards of aniline oil" (Discussion), 695.
"Keeping a rubber factory clean" (Jameson), 696-701.
"New stunts to promote safety in the rubber industry, including safety work at minimum expense" (Discussion), 688-690.

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Organic accelerators. In "Safety from the chemist's standpoint" (Weber), 693-694.
"Practical plans for medical supervision in rubber plants" (Quinby), 701-707.
"Reclaiming plants and their efforts toward safe operations" (Baker), 719-721.
"Safe handling of volatile liquids in rubber factories," 709-714.
"Safety first from the factory manager's viewpoint" (Whittelsey), 716-719.
"Safety—from the chemist's standpoint" (Weber), 691-694.
"Standard statistics for the rubber industry" (Watson), 683-686.
Solvents. In "Safety—from the chemist's standpoint" (Weber), 692.
Solvents (Discussion), 694.
Rubber Section:
Appointment of nominating committee, 688.
Committee chairmen for coming year, 722.
Engineering committee report, 709-714.
Health hazards committee report, 714-715.
Minutes of meeting, 683-722.
Report of nominating committee, 690.
Rules, Safety:
Enforcement of safety rules. In "Position, authority and responsibility of the safety officer" (Adams), 746-747.
In "Accident hazards in the textile industries and ways of meeting them" (Ingham), 826-831.
Rules for crossing watchmen. In "Gates, distant signs, and crossing watchmen as protection at highway grade crossings" (Metcalfe), 769-771.

"Safe Motor truck operation" (Cary), 505-508.
"Safe practice in handling sulphuric acid" (Crass), 185-189.
"Safe practices in by-products coke plants" (Marquard), 378-385.
"Safe practices in pouring in a foundry" (Root), 365-368.
"Safe practices in rolling mills" (Johnson), 386-393.
Safeguarding:
Discussion, 148-149.
"Fundamental principles of safeguarding" (Dickinson), 143-148.
"Fundamentals of safeguarding" (Sanford), 121-125.
"Mechanical safeguarding of equipment" (Talbot), 214-218.
"Mechanical safeguards" (Ballentine), 519-521.
Safety committees, see Committees, Safety.
"Safety engineering in the textile plant" (King), 819-823.
"Safety first—from a moral viewpoint" (Moore), 725-729.
Safety lamps: Discussion, 189-190.
"Safety man and athletics" (Discussion), 510-511.
Safety movement: Speech at "Get together luncheon" (McClellan), 654-657.
Safety Education, see Education, Safety.
Safety engineers, see Engineers, Safety.
Safety, Public, see Public Safety.
Safety signs, see Signs
Salisbury, R. C., "Getting results from plant safety committees," 125-127.
Sanford, G. E., "Fundamentals of safeguarding," 121-125.
"How can woodworking guards be kept in place," 879-881.
Sanitation:
Health and sanitation, Meeting of, General session, 97-120.
"Health and sanitation in the tannery" (Pope), 530-534.
"Keeping a rubber factory clean" (Jameson), 696-701.
"Underground toilets and sewage disposal for mines" (Williams), 489-494.
Satterfield, D. E., "Coming in contact with fixed structures," 791-792.
Saws: Circular horn saw. In "Mechanical side of accident prevention in the packing industry (Keene), 505.
Sayers, Dr. R. R., "First aid stations under ground," 484-488.
"Transportation of the injured in the mining industry," 323-329.
Schools, Safety work in:
Discussion, 581-583.
How school safety was floated in Cincinnati (McClain), (Discussion), 583-584.
"Outline of method of safety instruction in public parochial schools" (Payne), 238-239.
"Report of committee on school hazards" (Payne), 581.
"Reports on progress of safety education in various cities," 239-248.
"Safety instruction in public and parochial schools" (Payne), 33-39.
Safety patrol work. In "Rejecting the Grundys from safety first" (Roadifer), 252.
See also—Children, safety work with; Education, Safety.
Scott, Charles B., "Necessity of the support of executives in accident prevention work," 624-628.
Seip, R. H., "Traveling ways and signs," 471-481.
Service to Members Committee Report (Cameron), 16-17.
Sewage disposal: "Underground toilets and sewage disposal for mines" (Williams), 489-494.
Shaw, J. S., "Protection from excess pressures in chemical apparatus," 194-198.
Shaw, Robert A., Chairman, Automotive Section, 143-184.
Shaw, R. E., "Elimination of steam during pouring," 368-372.
Shedd, L. F. Discussion of Mr. Cease's paper, "What is on my mind," 802-803.
Shenton, R. W., "Better industrial lighting—why?" 77-82.

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Shields, Maj. M. J., "Standardization of first-aid and first-aid contests, with lists of qualified professional and lay judges," 495-498.
Sickness of employees, Time lost by:
"Adequate records of lost time in industry due to sickness" (Newman), 296-303.
Experience of Hood Rubber Co., Watertown, Mass. (Discussion), 303-304.
Signals, Grade Crossings, see
Grade Crossings—signs and signals.
Signals, Mine—see
Mines and mining—signs and signals.
Signs:
"Gates, distant signs, and crossing watchmen as protection at highway grade crossings" (Metcalfe), 768-771.
Railroad signs (Discussion), 771-772.
"Standardizing railroad crossing signs and grade crossings" (Messenger), 259-265.
"Traveling ways and signs" (Seip), 471-481.
"Social phases of safety work" (Rosebush), 565-567.
Solomon, E. L., "Animal haulage at anthracite coal mines," 410-414.
Solvents, see
Volatile solvents.
Spaeth, Dr. Reynold A., "The workday and industrial health," 97-100.
Spine: Discussion of Dr. Bradford's paper (Osgood), 335-340.
"Diseases and injuries with symptoms referable to the lumbar spine" (Bradford), 329-335.
"Standard statistics for the rubber industry" (Watson), 683-686.
"Standardization of statistics" (Hawes), 182-184.
Steam Railroad Section:
Delegates attending session, 723-725.
Election of officers, 765-766.
Joint meeting of the Steam Railway Section and the Electric Railway Section, 767-813.
Minutes of meeting, 723-813.
Resolution committee report, 742.
Steel industry, see
Iron and Steel industry.
"Storage battery locomotives" (Stuart) (Abstract), 408.
"Storage battery locomotives in metal mines" (Daveler), 400-404.
Stowell, D. H., Chairman, Textile Section, 815-835.
Street cars, see Electric railways.
Street traffic, see Traffic.
Stretchers:
Discussion, 328-329.
In "Transportation of the injured in the mining industry" (Sayers), 324-327.
Stuart, C. E., "Storage battery locomotives" (Abstract), 408.
Sulphuric acid, Safe practices in handling (Crass), 185-189.
Surgeons—Industrial: "Industrial surgery and first-aid" (McCann), 174-177.
Swartz, Nelle, "Industrial posture and seating," 845-850.
Switchboard recommendations for safety: In "Electrical hazards and proper installation of equipment" (Pefferly), 157-158.
Switches—Railroad: "Operating hand brakes and hand switches" (Orr), 788-790.

Talbert, C. M., Chairman, Public Safety Section, 569-620.
Talbot, Ray R., "Mechanical safeguarding of equipment," 214-217.
Tank cars: Unloading of acid tank cars. In "Safe practice in handling sulphuric acid" (Crass), 185-189.
Tanks, Safeguarding:
"Boilers and tanks or pressure vessels" (Morrison), 511-517.
Packing-house tanks. In "Boilers and tanks or pressure vessels" (Morrison), 515-517.
"Tanks in packing house" (Discussion), 518.
Tanning industry:
"Actual accident experience and its relation to insurance rates" (Kinghorn), 522-525.
"Health and sanitation in the tannery" (Pope), 530-534.
"Occupational hazards incident to the tanning industry" (Elder), 526-529.
Reduction in rates (Discussion), 523-525.
Tarbell, Ida, "Women, a new force in industry," 851-853.
Taylor, H. S., "Ventilation of paper mills from a building and safety standpoint," 554-558.
2
Telephone Industry:
Accident statistics. In "Development of accident prevention and first aid work in the telephone field" (Downey), 660-661.
"Development of accident prevention and first-aid work in the telephone field (Downey), 659-664.
Textile Industry:
"Accident hazards in the textile industries and ways of meeting them" (Ingham), 826-831.
Guarding cards (Discussion), 824.
Loom guards (Discussion), 823-824.
Spinners' open knives (Discussion), 831.
"Textile safety code" (Hitchcock), 815-818.
Textile Section:
Appointment of nominating committee, 815.
Minutes of meeting, 815-835.
Tillson, B. F., Chairman, Engineering Section, 49-75.
Chairman, Mining Section, 399-498.
Tinsley, John F., "The essentials of a plant safety organization," 129-132.
Toilets: "Underground toilets and sewage disposal for mines" (Williams), 489-494.
Tolman, C. P.:
Chairman, General session on public safety and education, 33-34.
Chairman, Joint meeting of manufacturing sections, 77-96.
President's address, 7-11.
Presiding officer, Annual meeting of members, 5-31.

Digitized by Google

Tools:
Hand protection for holder of chisel, 219.
Value of inspecting tools, 64.
Traffic:
"How vigilance committees work" (Price) (Discussion), 358-359.
Jay-walking. In "Publicity Committee report," 600-601.
Jay-walking ordinances (Discussion), 592-594.
Jay-walking ordinances. In "Pedestrian hazard committee report" (Kohler), 605.
Left-hand turns (Discussion), 616.
Mushroom traffic lights (Discussion), 615.
Pedestrian hazards (Discussion), 606-607.
"Public Safety" (Cole), 39-42; 44.
"Success in vigilante work" (Lee), 607-609.
Traffic hazards (Discussion), 591-594.
Vigilance Committees (Discussion), 609-613.
"Transportation of the injured in the mining industry" (Sayers), 323-329.
"Traveling ways and signs" (Seip), 471-481.
"Trolley locomotives for underground haulage from a safety standpoint" (Whiteside), 404-406.
Trucks,—see Automobiles.
Tuberculosis:
In "Duty of the states to include diseases of occupation under workmen's compensation" (Wilcox), 108.
"What has been done for the health of the industrial worker in Framingham?" (Armstrong), 114-119.
Turner, A. S., "Better industrial lighting—how?" 82-86.
"Using a camera to promote safety" Frampton), 543-547.

Ventilation and exhaust systems:
By-product coke plants. In "Safe practices in by-products coke plants" (Marquard), 385.
Discussion, 878-879.
"Elimination of steam during pouring (Shaw), 368-372.
"Exhaust systems for woodworking machines" (Nichols), 871-878.
"Ventilation of paper mills from a building and safety standpoint" (Taylor), 554-558.
Ventilation of rubber mills. In "Keeping a rubber factory clean" (Jameson), 698.
Vigilance Committees,—see Traffic.
Volatile solvents:
Discussion, 293-294.
Limits of flammability peculiar to each solvent. In "Safety in the evaporation of volatile solvents" (Lewis), 288.
"Safety in the evaporation of volatile solvents" (Lewis), 288-293.

Walker, Charles, "Beater room hazards," 552-553.
Wash rooms and change houses:
Shower baths. In "Health and sanitation in the tannery" (Pope), 531-532; 533.
Shower baths as an accident prevention measure (Discussion), 535-536.
Waste,—see Production increased by accident prevention.
Watkins, S. G., "Defects or failure of equipment", 757-758.
Watson, Ray N., "Standard statistics for the rubber industry," 683-686.
Weber, Dr. Lothar E., "Safety—from the chemist's standpoint," 691-694.
Welcome, Address of (Coonley), 5-7.
Welding,—see Oxy-acetylene welding and cutting.
"What has been done for the health of the industrial worker in Framingham?" (Armstrong), 114-119.
"What is on my mind" (Cease), 793-802.
White, Dr. Paul, "Problems of heart disease in the industrial worker," 306-313.
Whiteside, F. W., "Advantages of trolley locomotives for underground haulage from a safety standpoint," 404-406.
Whittelsey, Charles B., "Safety first from the factory manager's viewpoint," 716-719.
"Why Grinding Wheels Break" (Dodge), 149-154.
Wilcox, F. M., "Duty of the states to include diseases of occupation under workmen's compensation," 101-110.
Williams, R. C., "Underground toilets and sewage disposal for mines," 489-494.
Williamson, G. E., Chairman, Paper and Pulp Section, 539-568.
Woedtke, L. D. Chairman, Construction Section, 207-236.
Wolfiin, H. M., "Fire prevention and fighting in metal mines," 445-453.
Women in Industry: "Women, a new force in industry" (Tarbell), 851-853.
Women in Industry Section:
Appointment of nominating committee, 837-858.
Discussion of Ida Tarbell's paper, 854-856.
Election of officers, 858.
Minutes of Meeting, 837-858.
Woodworking Industries:
Accidents. In "Designing woodworking machinery to provide the highest degree of safety (Keown), 865.
"Designing woodworking machinery to provide the highest degree of safety" (Keown), 865-871.
Discussion of Mr. Chesworth's paper, 863-865.
"Exhaust systems for woodworking machines" (Nichols), 871-878.
Fire hazards (Discussion), 899.
"Fire hazards in woodworking plants (Newell), 890-898.
Guarding mortising machines (Discussion), 887.
"Guarding woodworking machines from the viewpoint of the operator" (Orris), 888-889.
"How can woodworking guards be kept in place" (Sanford), 879-881.
Legislation, 867-868.
"New Safety code for woodworking plants" (Chaney), 882-883.

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New safety code for woodworking plants (Discussion), 883-886.
"Organizing for safety in a woodworking plant" (Guilbert), 859-860.
"Safety efficiency in relation to woodworking plants" (Chesworth), 860-863.
Wooden guards (Discussion), 900-901.
Woodworking Section:
Appointment of nominating committees, 859.
Minutes of meeting, 859-903.
Report of nominating committee, 888.
"Work-day and industrial health" (Spaeth), 97-100.
Workmen, Injured:
"Transportation of the injured in the mining industry" (Sayers), 323-329.
Rehabilitation (Connelley), 658-659.
Utilizing convalescent men. In "Safety organization and method of operating and maintaining interest among shift bosses and foremen" (Cowperthwaite), 461-462.
Workmen's Compensation: "Duty of the states to include diseases of occupation under workmen's compensation" (Wilcox), 101-110.
Should diseases or occupation be included under workmen's compensation (Discussion), 110-114.
Worth, W. E.:
Business and Administration Committee report, 17-18.
"The need for accident prevention work and methods to be employed during the present industrial depression," 86-92.
Wounds: In "Occupational hazards incident to the tanning industry" (Elder), 527-528.
Wrecking: "Protecting the public" (Risteen), 220-221.
Wright, Dr. Wade, Fatigue (Discussion), 843-844.

Yates, B. C., "Provisions for Drinking Water," 481-482.

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